PB82-110354

Site-Specific Socioeconomic Impacts Seven Case Studies in the Ohio River Basin Energy Study Region

Ohio River Basin Energy Study
Urbana, IL

Prepared for

Environmental Protection Agency
Washington, DC

Aug 80

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/7-81-063		PB82 110354

4. TITLE AND SUBTITLE	5. REPORT DATE
Site-Specific Socioeconomic Impacts: Seven Case Studies in the Ohio River Basin Energy Study Region	August 1980
	6. PERFORMING ORGANIZATION CODE U272047

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Steven I. Gordon and Anna S. Graham	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
The Ohio State University Columbus, Ohio 43210	C2JN1E
	11. CONTRACT/GRANT NO. R805589

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
U.S. Environmental Protection Agency Office of Research and Development Office of Environmental Engineering and Technology Washington, D.C. 20460	14. SPONSORING AGENCY CODE EPA-ORD

15. SUPPLEMENTARY NOTES
This project is part of the EPA-planned and coordinated Federal Interagency Energy/ Environmental Research and Development Program.

16. ABSTRACT

This report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multidisciplinary policy research program supported by the Environmental Protection Agency. The general project focus is on the regional impacts of various alternative energy development futures in the study region, which consists of all of Kentucky, most of West Virginia, and substantial portions of Illinois, Indiana, Ohio, and Pennsylvania.

However, certain generalizations made at the regional level remain incompletely tested at the local scale; these questions may be especially important for some of the socioeconomic impacts associated with energy development. In this report, seven case study areas in the ORBES region are examined in terms of population, housing, economic status, and public services, and impacts of the ORBES scenarios in terms of population, housing, services, and taxes are presented. Finally, a method for generalization of the results is discussed, and a set of classifications of potentially impacted counties is presented and compared with the case study examples.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Energy Conversion Case Studies	Integrated Assessment Coal	

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS (This Report)	21. NO. OF PAGES
release to public	unclassified	99
	20. SECURITY CLASS (This page) unclassified	22. PRICE

EPA Form 2220-1 (9-73)

EPA-600/7-81-063

PB82-110354

SITE-SPECIFIC SOCIOECONOMIC IMPACTS: SEVEN CASE STUDIES IN THE OHIO RIVER BASIN ENERGY STUDY REGION

By

Steven I. Gordon
Anna S. Graham

The Ohio State University
Columbus, Ohio 43210

Prepared for

Ohio River Basin Energy Study (ORBES)

Grant No. EPA R805589

Project Officer

Lowell Smith
Office of Environmental Engineering and Technology
Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

DISCLAIMER

This report has been reviewed by the Office of Research and Development, U.S. Environmental Protection Agency, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the U.S. Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

FOREWORD

The Ohio River Basin Energy Study (ORBES) is an interdisciplinary, multi-university inquiry into the environmental, economic, and social impacts of energy facility development in a major portion of the Ohio River Basin. The study was initiated by the U.S. Environmental Protection Agency in 1976 in response to a directive from the U.S. Senate Appropriations Committee.

Most of the ORBES research was conducted by a group of faculty members at the University of Illinois, Indiana University, the University of Kentucky, the University of Louisville, The Ohio State University, the University of Pittsburgh, Purdue University, and West Virginia University. In a few instances, the necessary expertise was found at other universities or independent research organizations.

This report is one of a series produced in support of the overall ORBES assessment. For a summary of the entire study, see Ohio River Basin Energy Study (ORBES): Main Report, by the ORBES Core Team, also being published by the U.S. Environmental Protection Agency.

Table of Contents

Section	Title	Page
1.0	Introduction	1
2.0	Review of Related Literature on Local and Regional Socioeconomic Impacts of Power Plants . .	3
2.1	Introduction	3
2.2	Socioeconomic Impacts.	3
2.3	Classifying Potential Socioeconomic Impacts. . . .	5
3.0	Description of Case Study Areas.	10
3.1	Jasper County, Illinois.	17
3.2	Jefferson County, Indiana.	17
3.3	Spencer County, Indiana.	18
3.4	Trimble County, Kentucky	18
3.5	Adams County, Ohio	19
3.6	Beaver County, Pennsylvania.	19
3.7	Mason County, West Virginia.	19
4.0	Impact Analysis.	20
4.1	Introduction	20
4.2	Impact Analysis for the Period 1965-1975	20
4.2.1	Jasper County, Illinois.	22
4.2.2	Adams County, Ohio	25
4.2.3	Beaver County, Pennsylvania.	31
4.2.4	Overall Impacts, 1965-1975 Impact Analysis	34
4.3	Impact Analysis, 1975-2000	39
4.3.1	Projections of Employment Demand	39

Preceding page blank

Table of Contents (Cont'd)

Section	Title	Page
4.3.2	Population Impacts.	49
4.3.3	Housing Impacts	50
4.3.4	Public Water Systems Impacts.	55
4.3.5	Tax Impacts	56
5.0	Classification of Case Study Counties for Impact Evaluation	60
5.1	Classification in Other Studies	60
5.2	Classification of ORBES Candidate Counties.	62
6.0	Summary and Conclusions	76
Appendix A	List of Data Sources Used for Site Specific Analysis	81
Appendix B	ORBES Labor Impact Model.	84

List of Tables

Table Number	Title	Page
1	Potential Impact Variables	6
2	Existing and Planned Electric Generating Units for Case Study Counties	11
3	Demographic Characteristics of Case Study Counties and ORBES 1970-1975	13
4	1970 Census of Housing Data for Case Study Counties and ORBES	15
5	Labor Force, Employment and Income Data for Case Study Counties	16
6	Population and Population Growth for Jasper County Selected Years.	23
7	Employment for Selected Sectors and Annual Rates of Change - 1970, 1972, 1974, 1976 . .	24
8	Property Valuations for Jasper County for Selected Years	26
9	Expenditures and Revenue Data for Jasper County - 1970-1976	26
10	Population and School Enrollment for Adams County, Selected Years.	27
11	Employment and Unemployment for Adams County - Selected Years.	29
12	Expenditures and Revenues for Adams County - Adams County.	30
13	Property Valuations for Adams County Selected Years	30
14	Population and Population Growth for Beaver County - Selected Years	32
15	Employment and Employment Growth for Beaver County - Selected Years	33
16	Property Valuations for Beaver County	35
17	Expenditures and Revenues for Beaver County.	35

List of Tables (Cont'd)

Table Number	Title	Page
18	Partial Correlation Analysis Results	37
19	Regression Results for Actual and Predicted Employment	38
20	Information Sources for Power Plant Construction and Operation Schedules	40
21	Jasper County Energy Facility Information, Power Plant Employment and Inmigration 1975-2000	42
22	Jefferson County Energy Facility Information, Power Plant Employment and Inmigration 1975-2000	43
23	Spencer County Energy Facility Information, Power Plant Employment and Inmigration 1975-2000	44
24	Trimble County Energy Facility Information Power Plant Employment and Inmigration 1975-2000	45
25	Adams County Energy Facility Information, Power Plant Employment and Inmigration 1975-2000	46
26	Beaver County Energy Facility Information Power Plant Employment and Inmigration 1975-2000	47
27	Mason County Energy Facility Information, Power Plant Employment and Inmigration 1975-2000	48
28	Total Inmigration, Including Families and Percentage of 1975 Population - Case Study Counties, 1975-2000	51
29	Annual Building Rate and Housing Demand for Case Study Counties - 1975-2000	54
30	Estimated Jasper County Tax Impacts	58
31	Oak Ridge National Lab Indicator of Social Impact	61

List of Tables (Cont'd)

Table Number	Title	Page
32	Variables Used in the Taxonomy of Candidate Counties	63
33	Descriptive Statistics on Groupings Derived Using All Variables	66
34	Group Statistics for Selected Variables Using Alternative Classification Schemes . . .	72
35	Group Membership for Case Study Counties Groups Based on Variables In^2	74
36	Description of the Classification of Candidate Counties and Potential for Socioeconomic Impacts	75

List of Illustrations

Figure Number	Title	Page
1	Power Plant Site and Socioeconomic Issues	4
2	Impacted Years Associated with Power Plant Construction in Case Study Counties 1969-2000	21
3	County Impact Groups Using All Variables	65
4	County Impact Groups Using Income Variables . . .	68
5	County Impact Groups Using Employment Variables .	69
6	County Impact Groups Using Housing Variables . . .	70
7	County Impact Groups Using Population Variables .	71

1.0 Introduction

The general focus of the Ohio River Basin Energy Study (ORBES) is on the regional impacts of various alternative energy development futures in the study region. The full array of environmental, economic, and social impacts are being examined and evaluated in the context of a number of potential policies.

Given the focus at the regional level, the study must utilize readily available data at a scale congruent with regional analysis. Some generalizations must be made in order to give a concise summary of potential events and their impacts. These generalizations are subject to some variance, to a greater or lesser degree, depending on the type of data limitations and the nature of the impacts being evaluated. In addition, certain impacts at the local level defy generalization to the regional scale. For example, it makes little sense to generalize about the impacts of power plant development on regional housing since there really is no housing market on the scale of the ORBES region. This is in fact a rather local phenomenon.

Certain generalizations that are being made at the regional level remain incompletely tested or analyzed at the local scale. We may make generalizations about the migration impacts of energy development but in different types of communities the number and importance of these migrants may differ markedly.

These questions are particularly important for some of the socioeconomic impacts associated with energy development. The purpose of this report is to examine seven case study areas in the ORBES region in order to explicate and examine the nature of some of the socioeconomic impacts of power plants and their relationship to regional level impacts.

The purpose of this report is to summarize our findings in the socioeconomic impact analysis of power plants in seven case study counties in the ORBES region. The first chapter of the report provides an overview of regional socioeconomic impact analysis. Socioeconomic issues in siting are illustrated and discussed in the context of previous site specific and regional studies.

The next chapter begins our analysis of the seven case studies. A descriptive overview of the cases is given. Comparisons are made to the ORBES region as a whole. Then, each county is discussed in more detail in terms of population, housing, economic status, and public services.

The following chapter describes in detail our site specific impact analyses. Impacts on population, housing, services, and taxes are presented. This chapter also notes problems associated with this type of impact analysis stemming from lack of data or incomplete knowledge, while at the same time pointing out how indirect evidence can be brought to bear to obtain an assessment of impacts.

Finally, we discuss our own method for generalizing our results. A set of classifications of potentially impacted counties is presented and compared with our case study examples.

2.0 Review of Related Literature on Local and Regional Socioeconomic Impacts of Power Plants

2.1 Introduction

In recent years, several regional environmental/energy impact assessments have been undertaken (1). Each has taken a different approach to solving the question of how to generalize from local impact experiences to the regional setting. In fact, one of the major linkages of this report to the remainder of the ORBES work is to answer this question. Do certain communities have characteristics in common which make them more or less prone to various social impacts or is each situation unique? Are there data available at the local level which allow a more complete analysis of socioeconomic impacts?

This chapter reviews other, similar attempts to answer these questions. First, we define what is meant by the term "socioeconomic impact." Then we review past attempts to delineate and quantify such impacts in various circumstances. Finally, we review the other regional studies to see to what degree they have been able to answer the questions posed above.

2.2 Socioeconomic Impacts - Definition

A number of issues are included under the rubric of socioeconomic. Each impact analysis that has been carried out has chosen to emphasize and investigate a different set of such impacts.

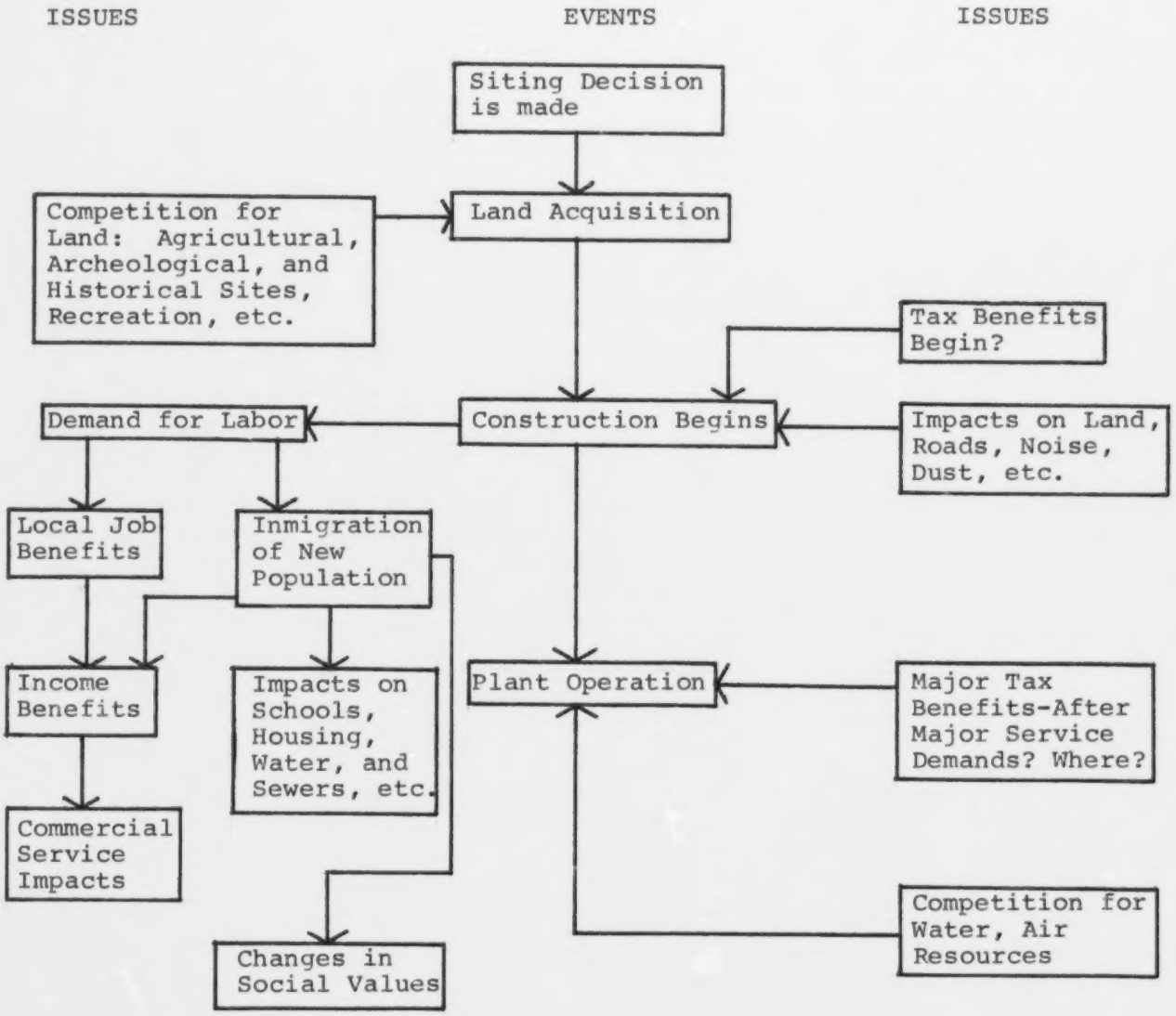
Figure 1 illustrates the general flow of events following a power plant siting decision along with the major socioeconomic issues. Throughout the siting process, each event has the potential for having both positive and negative impacts on the community. As is shown in Figure 1, land acquisition may entail a change in the tax-base of the community. The magnitude of the impact will vary depending on the size of the parcel, its former use, and the demand for land for other purposes. If some of the land on or adjacent to the site contains archeological or historical sites these too could become an issue. It is of course possible to choose sites in a manner which will minimize these problems. Nevertheless, they are potential socioeconomic issues which have arisen under a variety of circumstances.

At this time in the siting process, some tax benefits may accrue to the local community and/or the state. When these changes in assessed valuation and tax revenues occur depends both on the state tax laws and on local and state assessment practices.

Following the start of construction, several more sets of issues come into play. The construction activity will involve the use of heavy equipment and thus may have impact on local roads (along with the new

Figure 1

Power Plant Siting and Socioeconomic Issues



traffic), noise, dust, and so on. The construction work force itself may create both negative and positive effects. Some of the labor force may be local residents while others will inmigrate or commute from elsewhere. Thus, there are issues of income benefits, public service impacts, commercial service impacts (i.e. more local business) and a potential change in social values caused by the newcomers to the community. It is here also that the local tax issue is important. The peak labor demand and thus the peak public service impacts may precede the maximum tax benefits by several years. There can be short term problems in the community to pay for new service demands as well as long term tax benefits.

Finally, the operation of the plant will have similar demands on services along with an affect of competition for land, water, and air resources with other land use activities.

Figure 1 illustrates the wide range of issues which can arise from a power plant siting. A number of demographic and economic data can serve as indicators of the nature and extent of potential impacts. Ideally, the variables used would measure all aspects of the social system including descriptors such as population, housing, social services, health care, crime, social values, etc. Unfortunately, our investigation of available data in the first year of ORBES found that many such indicator data are either unavailable or when available, are collected for only parts of the region and on an inconsistent basis. For this reason, we have had to rely on information which is collected on a consistent basis even though it may be partially incomplete. These data are from the 1970 Census of Population, census estimates, and other special census materials such as County Business Patterns.

The types of variables available on this consistent basis is given as Table 1. In looking at Table 1, several things should be pointed out. First, it is obvious that there are many ways one might measure a socioeconomic impact. Second it often remains a matter of judgement as to whether some of these impacts are positive or negative. Such judgement can be based only on individual values and perceptions. There are almost as many perceptions of impacts as there are impact measures. One less obvious observation is that the data used as indicators are readily available only in the U.S. Census and related documents. Because of this, it is very difficult to accurately trace the socioeconomic status of an area where a power plant is sited and built within a time frame of 5-8 years (on the average).

2.3 Classifying Potential Socioeconomic Impacts

Looking at the impact variables in Table 1, it becomes evident that some method of grouping or classifying both impacts and communities where various impacts might occur must be undertaken in order that useful generalizations might be drawn and, where called for, appropriate ameliorative actions can be taken. Several studies have focused on particular types of impacts and/or methods of generalization. It is

Table 1

Potential Impact Variables

Data Type	Variable
Population	Total County Population
	Total White Population
	Total Negro Population
	Population by Age
	Total Urban Population
	Total Rural Population
	Migration Rate
Income	Per Capita Income
	Median Family Income
	Family Income by Income Class
	Number of Families below Poverty Level
Employment	Total Labor Force
	Occupation of Employed Persons
	Employment by Skill
	Total Employment
	Unemployment Rate
Housing	Total Number of Housing Units
	Age of Housing Units
	Water Source of Housing Units (public or private)
	Housing lacking plumbing
	Sewage disposal type
	Persons per Room
	Vacancy Rate
Agriculture	Land in Farms
	Number of Farms
Government	Expenditures and Revenues

useful to review these here before summarizing the methods of analysis we have chosen to use.

Sanderson and O'Hare review a number of socioeconomic impact methods as applied to energy development (2). They rate each of the methods they review according to a series of potential problems:

1) The method ignores important relationships

2) Same parameter used to measure two different impact phenomena

3) Dynamics ignored

4) Relationships among variables represented incorrectly

5) Regional parameters used to project subregional changes

6) Parameters estimated in the wrong time period

7) Undersized sample used

8) Parameters calibrated from biased or unrepresentative sample. (2, p. I-12 - I-13)

They also point out the positive aspects of each of the models.

The errors listed above stem from a number of factors. The most important of these is probably the fact that data on these types of impacts are very limited. Where data have been collected, they are generally inconsistent from case to case. Thus, socioeconomic impact models are constructed based on (frequently untested) indirect measures of potential impact, theoretical models which are overly simplistic, and some local data.

The few monitoring studies that have been undertaken, however, do appear to make many common observations. These include studies by Mountain West Research, TVA, and Pennsylvania Power and Light (3 through 14). All of these studies involved construction worker surveys during and following the construction period for plants of varying size and location. Although there is a good deal of variance in the study results several trends are apparent:

1) The construction projects in the Western U.S. show a much higher percentage of the work force moving to the construction area instead of commuting. Large metropolitan areas have mostly local workers because there is a larger available work force.

2) The percent of the labor force coming from the local area varies widely. For the TVA projects, the percentage of non-local workers goes up as the labor force increases. (See reference 15 for a more complete discussion) This may be explained by the variations in the need for skilled labor as the construction project progresses.

3) Non-local workers tend to rent rooms or live in mobile homes more often than local workers.

4) Construction workers tend to have median incomes $5000-$7000 above that of the local populace.

Combining these factors we can see that the potential for large socioeconomic impacts should increase in those areas with fewer local workers available, less available rental housing, and fewer available public services. Based on this hypothesis, several regional studies have sought to characterize power plant candidate sites and their surrounding communities based on the potential for impacts.

Urban Systems Research and Engineering (16) uses a factor analytic approach to classify 262 SMSA's (Standard Metropolitan Statistical Areas) into groups with similar characteristics based on 200 initial variables. The typology developed included data on ambient environmental quality, urban form and the physical environment, pollution residuals, and demographic characteristics. Representative cities from each group are suggested as case study sites which reflect the full range of possible variations.

Argonne National Laboratory used a classification scheme in a more specific application to socioeconomic impacts (1, 17). Counties where energy facilities might be sited were classified based on:

1) The size and age/sex composition of the population

2) The population density of the county and surrounding areas

3) The amount of service employment relative to basic (or industrial) employment in the county

4) The size and location of nearby regional trade centers

A clustering algorithm was used to assign counties to one of three groups: counties with low assimilative capacities and thus a high probability of adverse socioeconomic impact from energy development, counties with moderate assimilative capacity, and counties with high assimilative capacities.

A similar approach was taken in Phase I of the ORBES project (18). Here, six groups of candidate counties were derived, each with varying

capacities to absorb new development. This classification also differed in that a much larger array of socioeconomic indicators was used as input.

In all of these attempts to generalize local impacts to the regional level, no in depth analysis was performed to evaluate the usefulness or predictive power of the classification scheme. The monitoring studies reviewed above show a great variance from site to site in local impacts depending upon a range of local conditions. Yet, the regional studies choose only one, two, or three variables to characterize local areas and then to generalize about the potential for impact. This approach seemed overly simplistic to us. If generalizations are to be used with any confidence, their basis in fact must be more closely examined.

For these reasons, we have performed a test of various classification schemes. We compare the differences associated with utilizing different criteria as the indicator of potential socioeconomic impact. Further, we attempt to test the accuracy of these indicators using data from the ORBES case studies. Our methods and results are reported in the following chapters. (For further discussion of past classification efforts, please see Chapter 5).

3.0 Description of Case Study Areas

Several criteria were used in selecting the counties for the site specific analysis. The most important was that an energy facility be planned for a site within the county during the 1975 to 2000 period. Additional requirements were: 1) that the set of counties represent a wide range of socioeconomic and environmental characteristics, 2) that the power generating facilities in this set of counties represent the various size, fuel and cooling types that exist in the ORBES region, and 3) that counties undergoing additional analysis by support researchers be given some priority. The results of this selection process are listed below:

Jasper County, Illinois
Jefferson County, Indiana
Spencer County, Indiana
Trimble County, Kentucky
Adams County, Ohio
Beaver County, Pennsylvania
Indiana County, Pennsylvania
Mason County, West Virginia

A list of the planned and existing energy facilities for these counties as reported in the Electric Generating Unit Inventory prepared for ORBES by S. Jansen is shown as Table 2. We have attempted to update this inventory by contacting the utilities involved. From GPU we learned that Seward 7 was postponed indefinitely so Indiana County was dropped from our analysis. The other updates are included in the text and in the subsequent analysis.

It is important to understand the socioeconomic background of the case study areas for it is the existing character that is the prime determinant of the magnitude and severity of socioeconomic impacts that may result from energy development. For the purposes of this study 1975 was chosen as the baseline year; however, much of the socioeconomic data available comes from the 1970 Census. Housing data, one of the most important variables in socioeconomic impact analysis, is rarely available outside of the 1970 Census. Utilizing what information is available several tables have been compiled which demonstrate the range of characteristics present in the case study counties. A brief description of each of the counties will then follow.

The demographic characteristics of the counties are shown on Table 3. Beaver county, the largest county, is the only SMSA county as a part of the Pittsburgh SMSA. Only Beaver is larger than the ORBES average population with the remaining counties being one-half or less this number. Growth rates for the 1970-1975 period vary considerably although there are no negative rates. Also shown on this table is the dependency ratio. This ratio is equal to the dependents of the

Table 2

Existing and Planned Electric Generating Units
for Case Study Counties[a]

County	Plant Name	Unit	Size	On-Line Data	Type	Ownership[b]
Jasper	Newton	1	617	1977	coal	CEIP
		2	600	1981	coal	CEIP
		3	600	1984	coal	CEIP
Jefferson	Clifty Creek	1	225	1955	coal	INKE
		2	225	1955	coal	INKE
		3	225	1955	coal	INKE
		4	225	1955	coal	INKE
		5	225	1955	coal	INKE
		6	225	1955	coal	INKE
	Marble Hill	1	1130	1982	nuclear	PSIN, WVPA
		2	1130	1984	nuclear	PSIN, WVPA
Spencer	Rockport	1	1300	1981	coal	INME
		2	1300	1982	coal	INME
Trimble	Trimble	1	495	1983	coal	LOGE
		2	495	1985	coal	LOGE
		3	675	?	coal	LOGE
		4	675	?	coal	LOGE
Adams	J M Stuart	1	610	1971	coal	DAPO, CIGE, COSO
		2	610	1970	coal	DAPO, CIGE, COSO
		3	610	1972	coal	DAPO, CIGE, COSO
		4	610	1974	coal	DAPO, DIGE, COSO
	Killen	1	600	1985	coal	DAPO, CIGE
		2	600	1982	coal	DAPO, CIGE
Beaver	Mansfield	1	917	1976	coal	CLEI, PEPC, OHEC, DULC
		2	917	1977	coal	CLEI, PEPC, OHEC, DULC, TOEC
		3	917	1980	coal	CLEI, PEPC, OHEC, DULC, TOEC
	Shippingport	1	60	1977	nuclear	DULC
	Beaver Valley	1	885	1978	nuclear	OHEC, DULC
		2	885	1984	nuclear	OHEC, DULC, CLEI, TOEC

Table 2 (continued)

County	Plant Name	Unit	Size	On-Line Data	Type	Ownership[b]
Indiana	Conemaugh	1	820	1971	coal	PEEC, MEEC
		2	820	1971	coal	PEEC, MEEC
	Homer City	1	660	1969	coal	PEEC, NEYE
		2	660	1969	coal	PEEC, NEYE
		3	693	1977	coal	PEEC, NEYE
	Seward	3	35	1941	multi	PEEC
		4	62	1950	multi	PEEC
		5	156	1957	coal	PEEC
		7	800	1984	coal	PEEC
Mason	Phil Sporn	1	153	1950	coal	APPC, OHPC
		2	153	1950	coal	APPC, OHPC
		3	153	1951	coal	APPC, OHPC
		4	153	1952	coal	APPC, OHPC
		5	496	1960	coal	APPC, OHPC
	Mountaineer	1	1300	1980	coal	APPC

Source: Steven D. Jansen, Electrical Generating Unit Inventory 1976-1986, Prepared for ORBES, November, 1978.

Notes: a) Actual on-line dates for planned plants may differ from this list. These will be noted in the text.

b) Ownership Codes:

CEIP	Central Illinois Public Service Co.
INKE	Indiana-Kentucky Electric Corp.
PSIN	Public Service Co. of Ind., Inc.
WVPA	Wabash Valley Power Assoc.
INME	AEP: Indiana and Mich. Electric Co.
LOGE	Louisville Gas and Electric Co.
CIGE	Cincinnati Gas and Electric Co.
COSO	Col's. and Southern Ohio Electric Co.
DAPO	Dayton Power and Light Co.
CLEI	Cleveland Electric Illuminating Co.
DULC	Duquesne Light Col.
OHEC	Ohio Edison Co.
PEPC	Penna. Power Co.
TOEC	Toledo Edison Co.
PEEC	GPU: Penna. Electric Co.
MEEC	GPU: Metropolitan Edison Co.
NEYE	NY State Electric and Gas Corp.
APPC	AEP: Appalachian Power Co.
OHPC	AEP: Ohio Power Co.

Table 3

Demographic Characteristics of Case Study Counties and ORBES 1970-1975

County	1970 Population	1975 Population	% Change Population	1970 % Rural	1970 Dependency Ratio
Jasper	10,741	11,198	4.3%	71.9%	80.1
Jefferson	27,006	27,622	2.3	40.4	63.7
Spencer	17,134	17,631	2.9	85.0	73.8
Trimble	5,349	5,617	5.0	100.0	72.1
Adams	18,957	22,299	17.6	100.0	76.6
Beaver	208,418	209,328	0.4	23.4	59.7
Mason	24,306	25,254	3.9	74.8	65.8
ORBES Mean	54,435	55,589	4.7	66.9	67.9

Sources: U.S. Bureau of the Census, 1970 Census of Population.
U.S. Bureau of the Census, Current Population Reports, Series P-25, May 1977.

population (those under 15 years of age plus those 65 or over) divided by the working-aged population (those between 15 and 64 years of age) times 100. In general, these dependents demand more of the public service sector in terms of education, health and welfare services. At the same time, their input into the public sector in terms of tax revenues from income, property and sales tax is generally very small. Therefore, a high dependency ratio can mean a disproportionate demand for public services compared to a county of equal size and lower or average dependency ratio. There appears to be a negative relationship between population size and the dependency ratio for this group of counties. The smaller counties have a higher proportion of dependents than the larger counties. This indicates that the smaller counties could be more heavily burdened by public services demands, such as schools and health services for the elderly. The range of dependency ratios across the case study counties is almost as great as that for the ORBES region.

Housing data from the 1970 Census are shown on Table 4. The condition and attractiveness of the housing stock is indicated by the availability of plumbing, water and sewer services. The two relatively urbanized counties (Beaver and Jefferson) fare the best in terms of these services. The other counties rank below the ORBES average.

The vacancy rate indicates the percentage of housing units that are vacant at the time of the survey (1969). A high percentage of vacant housing may be the result of 1) a period of population growth and building followed by out-migration or 2) the lack of public services available to a portion of the housing stock combined with substandard housing conditions. In the case of increased housing demand induced by power plant construction, most of these vacant units could be occupied.

Income, labor force and employment characteristics for the case study counties and ORBES are shown on Table 5. Income levels range from a low of $5563 in Adams County (also Ohio's lowest) to $9428 in Beaver County. The range for the ORBES region is $2407 (in Kentucky) to $11694 (in Ohio).

Manufacturing employment is a relatively small proportion of total employment in Adams and Jasper counties - both rural areas. Jasper also has the highest unemployment rate. Almost half of the total employment in Beaver County is in manufacturing.

A description of the socioeconomic characteristics of the counties on a county by county basis is provided below. A list of the references used to compile the detailed information for these counties is shown as Appendix A.

Table 4

1970 Census of Housing Data for Case Study Counties and ORBES

	Total Housing Units	% Lacking Some Plumbing	% Public Water	% Vacant	% With Public Sewers
Jasper	3901	18.1	38.1	7.3	29.1
Jefferson	8553	11.2	73.1	7.8	55.6
Spencer	5479	16.7	47.9	7.7	24.0
Trimble	1798	31.8	58.6	5.7	2.5
Adams	6846	37.9	43.9	11.3	30.0
Beaver	65942	3.7	79.7	2.8	66.8
Mason	8193	24.9	53.8	9.5	42.3
ORBES mean	18450	19.2	55.5	7.7	42.6

Source: U.S. Bureau of the Census, 1970 Census of Housing.

Table 5

Labor Force, Employment and Income Data for Case Study Counties

1970

County	Median Family Income	Total Labor Force	Unemployment Rate	Total Employment	Employment in Manufact.	% of Total Employment in Manufact.
Jasper	$8031	3,828	10.6%	3,423	506	14.8%
Jefferson	8556	10,253	3.4	9,902	3,093	31.2
Spencer	7785	6,498	3.7	6,256	2,131	34.1
Trimble	6596	1,864	2.0	1,826	525	28.8
Adams	5563	6,042	5.4	5,714	1,039	18.2
Beaver	9428	77,734	3.7	74,864	35,791	47.8
Mason	6768	7,576	6.6	7,074	1,989	28.1
ORBES mean	7672	20,847	5.9	19,726	6,109	27.7

Source: U.S. Bureau of the Census, 1970 Census of Population.

3.1 Jasper County, Illinois

Jasper County is located in southeastern Illinois, off the main stem of the Ohio River, approximately 45 miles from Terre Haute, Indiana, the closest city. It is a small rural county that has a large elderly population (16.1% of population is 65 or over) and therefore a high dependency ratio. In spite of the high number of dependents the per capita income level ($2592) is the second highest among the case study counties, although it must be noted that the state of Illinois average per capita income ($3495) is considerably higher.

The major employers for Jasper County in 1975 were manufacturing and wholesale and retail trade. Unemployment rates were extremely high for that year as well as in 1970. Total employment figures show declining values between 1970 and 1974.

Public water and sewerage services were available only to approximately one-third of the housing units in 1970. Medical services are meager in the county. There is no hospital within its boundaries and only one full-time practicing physician.

Jasper County is the site of the Newton Power Plant, owned by Central Illinois Public Service Co. According to CIPS, three coal-fired units are being constructed. Site clearing for the first unit began in 1972, operations began in late 1977. The other two units are projected for 1981 and 1984 on-line dates.

3.2 Jefferson County, Indiana

Jefferson County is located on the Ohio River in the southeastern portion of Indiana directly opposite Trimble County in Kentucky (another case study county). It is a small semi-urbanized (greater than 55% urban) county approximately 55 miles south of Cincinnati and 35 miles north of Louisville.

The housing units in Jefferson county are somewhat better served by public water and sewer services than the other case study counties. There are plans to expand the sewer systems in 1980 since the septic tank system could prove inadequate in the event of considerable immigration. The percentage of housing units lacking some plumbing is also lower in Jefferson than in the other counties.

The major manufacturing groups in 1974 were lumber and wood products and machinery except electrical. Madison, the county seat, is the site of 94.6% of all the manufacturing establishments in the county.

Two hospitals in the county have 920 beds to serve the public. New school facilities which serve southwestern Jefferson county were constructed in 1976 near Hanover.

The Clifty Creek Power Plant is situated in the Ohio River downstream from Madison in Jefferson County. Built in the 1950's, the 1300 MW coal-fired plant is still in operation. The Marble Hill nuclear power plant began construction under a limited work authorization in 1977. The first unit is expected to be on-line in late 1982, the second in 1984. This 2260 MW pressurized water reactor plant is owned by Public Service of Indiana and Wabash Valley Power Association.

3.3 Spencer County, Indiana

Spencer County is located on the Ohio River across from Owensboro, Kentucky, 35 miles east of Evansville, Indiana. A small, rural county, Spencer has no hospitals or clinic facilities. Owensboro, Kentucky's health service facilities are used by the county's residents. Public sewer and water systems are available to less than one-half the housing units in the county.

The major employers in Spencer County are:

Rockport Sanitary Pottery
Abbey Press
Barmet Industries

each of which is in the category of 100-250 employees. Approximately one-third of the employed are employed in the manufacturing industries.

The Rockport coal-fired generating plant is just north of Rockport, Indiana, the county seat. Owned by Indiana and Michigan Electric Co., the two-unit 2600 MW plant is expected to begin operation in 1983 (1st unit) and 1984 (2nd unit). Construction began in 1977.

3.4 Trimble County, Kentucky

Trimble County is in northern Kentucky along the Ohio River, roughly halfway between Cincinnati and Louisville. This is a completely rural area with no public sewers and many housing units lacking some plumbing. It has a very small population base - only slightly more than 5,000 people.

Louisville Gas and Electric has planned to build a four unit coal fired plant in Trimble county. The first unit is expected to come on-line in 1984, the second in 1985. Construction began in 1979. No other energy facilities exist in the county although the Clifty Creek Plant in Jefferson County, Indiana is just across the river.

3.5 Adams County, Ohio

Adams county is also situated on the Ohio River, 50 miles east of Cincinnati. Although Adams county is not the smallest in population size of the case study counties it is the poorest (median family income of $5563) and contains the highest percentage of housing units that lack some plumbing (37.8%). It is a rural area with a high dependency ratio. Over one-third of the housing units are classified as substandard. Less than 20% of the employed work in the manufacturing industries. In spite of all of these "negative" characteristics, Adams had a 17.6% growth rate in population over the 1970-1975 period.

The JM Stuart coal-fired electric generating plant with four units totaling 2440 MW was completed from 1970 to 1974. The Killen plant, 1200 MW in 2 coal-fired units, began full-scale construction in 1976. Unit 1 is expected to be on-line in 1982, unit 2 in 1985.

3.6 Beaver County, Pennsylvania

Beaver county is the largest in population size and the only SMSA county of the case study counties. It is part of the Pittsburgh SMSA in western Pennsylvania on the Ohio River. Beaver County is an urbanized area with adequate public services (sewer and water, hospitals); low vacancy rate, low dependency ratio and high median family income. Almost 50% of the employed work in the manufacturing industries, primarily in primary metals industry.

Two power plants are being constructed in the county. The Bruce Mansfield coal-fired plant will have three 917 MW units with on-line dates in 1976, 1977 and 1980 respectively. Four utility companies jointly own this plant. The Beaver Valley plant is a nuclear plant with 2 units at 885 MW each scheduled to be on-line in 1977 and 1982. This is also a jointly owned plant.

3.7 Mason County, West Virginia

Mason County is situated on the Ohio and Kanawha Rivers in western West Virginia, approximately 45 miles north of Huntington. It is a rural county with almost one-quarter of the families below the poverty level. One hospital with 127 beds is located in the county. New wells were being planned to double the current output for the public water supply system. Two major manufacturing firms in the area are Foote Mineral Company with 491 employees and the Goodyear Tire and Rubber Company with approximately 500 employees.

The Mountaineer plant is planned to be on-line in Mason county in 1980. It is a single unit, 1300 MW coal-fired plant owned by Appalachian Power Co. Construction began in 1974 but was interrupted shortly thereafter and construction was delayed until 1977.

4.0 Impact Analysis

4.1 Introduction

This chapter presents our impact analysis for the seven case study counties. The impacts examined include population, employment, services, and taxes. For each case study area, a somewhat different set of data were available. This means that the emphasis of our impact analysis differs somewhat from case to case. It should be pointed out that this difference in emphasis is solely one associated with information available and in no way implies judgement as to the importance of each impact.

The impact analysis is divided into several parts. In the first part we examine impacts which have occurred in the recent past. This applies to only three sites. In the second, we utilize several projection models along with the data in environmental impact statements to gain insights into the impacts that could or are occurring at each of the seven sites.

The primary criteria for selection as a case study area was that an energy facility be planned for a site within the county. Each of the chosen counties, therefore, has been designated by a utility as a future site for energy development. Information on electric generating units in the case study areas was presented on Table 2 in the previous section. Planned units with on-line dates past 1975 are the basis of the impact analysis performed for the case study counties.

A diagram has been constructed (see Figure 2) to show the 'impacted' years associated with each of the units with on-line dates between 1965 and 2000. Assuming that one coal unit takes five years and one nuclear unit takes seven years, the time line represents the construction period with the asterisk indicating the peak employment year (assumed to be the fourth year of construction for both types of plants). When actual construction dates were available these were used rather than the assumptions. From Figure 2 we can see that three of the seven counties were experiencing power plant construction activity during the period 1970-1975 (based on the above assumptions). Since the ORBES socioeconomic data base encompasses this time period we can examine the trends in population, employment and public sector activity for these counties. From this information we may be able to identify some changes that could be associated with the construction activity.

4.2 Impact Analysis for the Period 1965-1975

The three counties experiencing power plant construction activity during the 1965-1975 period are Jasper, Adams, and Beaver. We have attempted to collect detailed data covering this period. These data were requested from county and regional planning agencies, state and

Figure 2. Impacted Years Associated with Power Plant Construction in Case Study Counties, 1965-2000.

Note: The megawatt size, number of units, and coal (c) or nuclear (n) type is indicated above the time lines.

county auditor's offices, state and county tax offices, boards of education and so forth. Additional Census data was compiled from the County Business Patterns (employment data) and Current Population Reports series. Data sources are noted in Appendix A. Each of the counties will be examined separately below. The trends or changes that have occured over this time period may or may not be related to the construction activity. For the most part we do not have sufficient information to make that judgement. However we can indicate the change and suggest possibilities for its cause.

4.2.1 Jasper County, Illinois

The Newton Plant, Unit 1, started operations in Jasper County in 1977. Construction began in late 1972. Typically, peak employment occurs in the third or fourth year of the construction period or 1975-1976 for Newton 1. Although the data are meager and do not cover the entire construction period there is some evidence of possible related impacts in terms of construction employment and property valuations. Trends in population growth are shown in Table 6. Please note that the 1975 and 1976 figures are estimates. Although the trend for declining population was broken for the period 1970 to 1975 there appears to have been no substantial inmigration.

Employment figures for total employment and three major industrial groups are shown on Table 7. We must be careful when reviewing employment figures from County Business Patterns for three reasons:

1) They include only those employees covered by workmen's compensation hence many employees are simply not counted and an increase over time could mean new 'covered' employees and not new employees.

2) They come from 'place of work' data hence comparisons with census data cannot be made since the census uses 'place of residence' data.

3) Part of the construction work force may be counted in the county where the contractor's headquarters are located rather than the worksite.

For our purposes it is just as important to note that there was a substantial number of workers in the construction industry in 1976. It appears that the workers have not, for the most part, migrated to Jasper and there has yet to be an effect on employment in other industries, unless it has been one of reversing a declining trend.

Table 6

Population and Population Growth for Jasper County Selected Years

Year	Population	Annual Rate of Change	% Change
1960	11,346		
		-605	-5.3
1970	10,741		
		21	0.6
1973	10,805		
		197	3.6
1975	11,198		
		-147	-1.3
1976	11,051		

Sources: U.S. Bureau of the Census, 1970 Census of Population,
U.S. Bureau of the Census, Current Population Reports, Series P-25.

Table 7

Employment for Selected Sectors and Annual Rates of Change
1970, 1972, 1974, 1976

Year	Total Empl.	Annual Rate of Change	Construction	Annual Rate of Change
1970	1420		28	
1972	1224	-98	103	37
1974	1602	189	46	-28
1976	2146	272	(500-999)	na

Year	Manufacturing	Annual Rate of Change	Services	Annual Rate of Change
1970	542		157	
1972	253	-144	95	-31
1974	607	177	157	31
1976	576	-15	162	2

Source: U.S. Bureau of the Census, County Business Patterns 1970 to 1976

Information on property valuations is presented in Table 8. The large increase from 1975 to 1977 may be due to the valuation of the plant itself. This would be expected since the first unit was completed in 1977. This increase in property valuations can effect the county residents in several different ways;

1) property tax rates can sharply decrease

2) government revenue can sharply increase allowing public expenditures on capital improvements and so forth

3) a smaller tax rate decrease may be accompanied by increased expenditures.

Neither tax rates nor expenditures data for 1977 were made available to us so we cannot speculate as to the effect the increased property valuations had on county residents. Later, we address this question through the use of a simple model.

Expenditures and tax revenue data are available for selected years (see Table 9). The most obvious change shown on this table is for expenditures on highways. During the construction period (1972-1977) huge amounts of money (relative to total expenditures) were expended for highways. In 1974 highway expenditures were 60% of total expenditures. Highway improvements and maintenance are one of the most significant impacts from energy development. Commuter traffic and heavy truck traffic during construction decrease the expected life of roads and bridges leading to the site. New roads or 'widened' roads may be necessary to support the increased traffic. Sometimes, the utility company will either defray part of the costs or make the necessary improvements themselves for the highways adjacent to their property. In most areas, county governments such as Jasper still bear most of the burden for highway maintenance. Note also that increased tax revenue from the power plant would not be expected until 1977 or later (after property valuations increase). Hence the funds used for highway expenditures in 1974 and 1975 do not, for the most part, originate from tax revenue gained from the utility company. Thus, we have our first indication of a timing problem with regard to tax revenues and public expenditures required for an energy facility. This could create short term community problems.

4.2.2 Adams County, Ohio

Four units of the J.M. Stuart plant were on-line in Adams County in 1970, 1971, 1972 and 1974 respectively. Based on the assumptions used in Figure 2 for construction periods, construction activity was in progress from 1965 to 1974. Population and school enrollment data for this period is presented in Table 10. The enrollment data for

Table 8

Property Valuations for Jasper County for Selected Years

Year	Property Valuation
1970	$47,241,000
1974	$58,678,448
1975	$66,030,569
1977	$104,630,487

Source: Illinois, Department of Local Government Affairs

Table 9
Expenditures and Revenue Data for Jasper County
1970-1976

Year	Total Expenditures	Highway Expenditures	Tax Revenues
1970	$ 405,370	$ 71,878	$ 305,556
1974	896,092	535,743	377,625
1975	883,481	335,898	428,475
1976	583,412	223,387	550,208

Sources: Jasper County Clerk
Illinois Comptrollers Office: Statewide Summary of Finance

Table 10
Population and School Enrollment for Adams County, Selected Years

Year	Population	Annual Rate of Change	School Enrollment	Annual Rate of Change
1960	19,982			
		-102		101
1965	na		5070	
		850		134
1970	18,957		5575	
		396		5
1973	21,507		5979	
		-129		-1
1975	22,299		5989	
1976	22,170		5988	

Sources: U.S. Bureau of the Census, 1970 Census of Population.
U.S. Bureau of the Census, Current Population Reports, Series p. 25.

1965-1970 suggest that the entire 1960 to 1970 period may not have had negative population growth and that, in fact, 1965 to 1970 may have been a period of population growth. However, population data for 1965 are not available to support this.

Employment data (see Table 11) show a slightly different pattern of change than the population data. The period of negative growth for employment is 1972-1975; for population it is 1960-1965 and 1975-1976. Again, we must remember that employment data is by 'place of work' and that a declining population could be accompanied by a steady or increasing number of commuters or vice versa.

We used the ORBES labor impact model (see Appendix B for a brief explanation of the model) to estimate labor demand for construction of the JM Stuart Plant. The peak employment occured in 1968 with demand of approximately 1690 workers. The largest annual rate of change for employment growth (see Table 10) was 1970-1972; for population, 1970-1973. From a conversation with Mrs. Roush of the Adams County Regional Planning Commission and from more detailed data in the County Business Patterns we discovered that a large factory manufacturing refrigeration units was opened in the county around 1972. This plant employs approximately 500 people. The combined indirect effects from the energy facility and the factory are difficult to ascertain from Table 11 since total employment decreased by 54 workers between 1972 and 1975. Even so, there is little chance that we could separate the factory indirect employment impacts from those resulting from the construction and operation of the JM Stuart Plant.

According to Mrs. Roush, the growth in Adams County during the 1970-1975 period was caused by a combination of four concurrent situations

1) the Copeland factory mentioned above
2) urban to rural migration
3) increased building of recreational homes
4) JM Stuart and Killen Power plants

Fiscal data for the county is available for the years 1970, 1972 and 1975 (See Table 12). The large increase in expenditures from 1972 to 1975 was made possible, in part, through the issuance of $1.4 million general obligation notes. One of these notes was issued and redeemed in both 1974 and 1975. They were expended for capital improvements. We do not have any information on the nature of these capital improvements so we cannot speculate as to the basis or cause of the need for these improvements. Although it is not noted in Table 12, highway expenditures jumped to $965,849 in 1973 indicating a 43% increase over 1972. The highway improvements could have been required as a result of either the energy facility construction traffic or the factory traffic.

Table 11

Employment and Unemployment for Adams County
Selected Years

Year	Total Empl.	Annual Rate of Change	Construction	Annual Rate of Change
1965	1438		23	
		23		20
1970	1555		122	
		482		14
1972	2519		150	
		-218		-35
1975	1865		46	
		355		4
1976	2220		50	

Year	Manufacturing	Annual Rate of Change	Services	Annual Rate of Change
1965	591		106	
		-37		26
1970	404		145	
		330		15
1972	1064		176	
		-106		0
1975	745		176	
		119		0
1976	864		176	0

Year	Unemployment Rate	Annual Rate of Change
1970	9.9	
		1.25
1972	12.4	
1975	21.5	

Sources: U.S. Bureau of the Census, County Business Patterns
Ohio Bureau of Employment Security

Table 12

Expenditures and Revenues for Adams County
Selected Years

Year	Total Expenditures	Highway Expenditures	Revenues
1970	$ 1,555,834	$ 700,204	$ 1,486,378
1972	1,992,085	677,028	2,075,057
1975	5,906,415	908,293	3,555,053

Source: Auditors of State of Ohio, Financial Reports: Ohio Counties

Table 13

Property Valuations for Adams County
Selected Years

Year	Property Valuations
1965	$ 20,098,530
1970	28,320,380
1973	30,850,370
1975	62,359,400
1976	63,132,610

Source: Ohio Department of Tax Equalization

Property valuations had a significant increase over the 1973-1975 period (See Table 13). This was alsc the time period during which the final units of the JM Stuart Plant were to go on-line. The valuation of the new factory might also be included in this increase although it appears that the opening of the plant may have taken place in 1971-1972.

The 1965-1975 period was one of growth for Adams County. Several phenomena may have been responsible for these increases in the small rural county. We cannot say with certainty which phenomenon was the overriding factor of change. Associated with any population change from any cause are the effects on school enrollment, housing, demand for public services and tax revenue. However, the size of the work force needed to build the JM Stuart Plant and the relatively long construction period indicate that some inmigration (even though it may be temporary) would be expected. Certainly, the doubling of the property valuations between 1973 and 1975 must be at least, in part, associated with the JM Stuart Plant.

4.2.3 Beaver County, Pennsylvania

Two power plants were under construction between 1970 and 1975 in Beaver County. The Bruce Mansfield plant, coal-fired units 1 and 2, (under our scheduling assumptions) would be under construction starting in 1971. The construction of the first unit of the Beaver Valley nuclear plant would have begun work in 1970. The total impacted years for these three units would be 1970 to 1977, however, a third unit of the Mansfield plant and the second unit of the Beaver Valley plant would, under our assumptions, have begun construction in 1975.

Population data for the 1960 to 1976 time period is shown on Table 14. Although the peak year for population was 1973 both the absolute and percentage increases for 1970-1973 were small. Counties of this size would be expected to have little or no inmigration resulting from power plant construction activity.

Employment data are shown on Table 15. Except for the changes in construction employment there appears to be no other trends that can be associated with the construction activity. The increase in manufacturing, 1972-1974, is very short-lived and amounts to less than 6% increase over that period. The peak years for direct labor impacts, according to our model, would be 1973 to 1975. The peak labor demand is projected to be approximately 3,800 workers. According to the County Business Patterns, the increase in construction employment from 1972 to 1974 is only 833 employees with a total of 2,337 employees. Many of the workers at the plant must be either not covered by workmen's compensation, not categorized under 'construction' or have headquarters in another county. A better indicator of the direct and indirect employment effects of energy development is needed, such as direct surveys of workers.

Table 14

Population and Population Growth for Beaver County
Selected Years

Year	Population	Change of Population	Percentage of Change
1960	206,948		
		147	.7%
1970	208,418		
		457	.7
1973	209,788		
		-230	-.2
1975	209,328		
		-435	-.2
1976	208,893		

Source: U.S. Bureau of the Census, 1970 Census of Population
U.S. Bureau of the Census, Current Population Reports
Series p-25.

Table 15

Employment and Employment Growth for Beaver County
Selected Years

Year	Total Empl.	Annual Rate of Change	Construction	Annual Rate of Change
1970	62,514		1,803	
		-1716		-149
1972	59,081		1,504	
		2427		406
1974	63,935		2,337	
		57		205
1976	64,050		2,747	

Year	Manufacturing	Annual Rate of Change	Services	Annual Rate of Change
1970	40,531		6,790	
		-1963		95
1972	36,604		6,980	
		1015		338
1974	38,634		7,656	
		-409		321
1976	37,816		8,298	

Source: U.S. Bureau of the Census, County Business Patterns 1970-1976.

The data on property valuations reveal no changes that can be identified with the energy facilities or any other growth inducer. (See Table 16).

The data on county expenditures and revenues (see Table 17) show a change over the 1970 to 1974 period that may or may not be associated with the energy development. Since there was little or no immigration during this period the increased expenditures and revenues must be due to the demands placed by the energy facilities themselves (highway maintenance or improvements, other infrastructure additions or improvements near the plant) or to some major capital improvements that were funded at this time.

As we had expected there were few traces of the impacts related to energy development in Beaver County. Labor demands are easily absorbed by a large population base. The lack of inmigrants also diminishes the associated indirect employment effect.

4.2.4 Overall Impacts, 1965-1975 Impact Analysis

Overall, the historical data has reinforced some of our basic ideas concerning socioeconomic impacts of construction of electric generating units. We hypothesized that the larger the population size, the more urban and the wealthier the county the smaller the impact. Beaver County, a relatively large county which is part of the Pittsburgh SMSA, showed little or no evidence of employment, population, public expenditures or property valuation impacts. Conversely, Adams County, a small, rural and poor county, experienced large population increases, increased public expenditures and revenues, employment changes and property valuation increases. Unfortunately, we can not attribute these changes to power plant construction alone. Other concurrent development was underway during this period that could have had a major impact in these same areas of concern. In this type of 'ex post' analysis the problem arises to identify the causes which precipitated the documented change such as in population or property valuation noted above. When linkages are known or straightforward it is a relatively simple matter. Sources of changes in property valuation can be traced by going through the county assessor's books parcel by parcel. It is a rather tedious and time-consuming task but the documents are in the public domain and accessible. Changes in population or employment are not as easily traced because we need to know more than the obvious. For example,we need to know why the people moved to Adams County or what stimulated industrial growth.

The:

a) opening of new businesses, factories, military, health or penal institutions
b) increased demand for rural recreational homes or
c) development of energy or transportation facitities

Table 16

Property Valuations for Beaver County

Year	Property Valuations
1970	$ 303,580,750
1972	318,839,440
1975	330,056,590

Source: Pennsylvania Abstracts

Table 17

Expenditures and Revenues for Beaver County

Year	Expenditures	Revenues
1970	$ 9,035,000	$ 4,920,000
1974	17,363,000	6,059,000
1975	16,386,000	6,163,000

Source: Pennsylvania Abstracts

can all have similar effects on population and employment growth. The closing of such facilities can have an opposite effect. When several of these events occur concurrently it is very difficult to separate out the effects of one from the other. It is likely that there could be synergistic effects as well. With our limited knowledge of the 'growth inducing' or 'growth reducing' situations in the case study counties, we must limit our conclusions concerning the observed indirect and direct effects from power plant construction.

Realizing that employment in manufacturing may be an indicator of concurrent industrial development, we decided to perform some statistical tests to see if power plant construction employment correlated with total employment while holding manufacturing employment constant. We chose to use partial correlation analysis and multiple regression analysis as these tests. Using the model-derived construction and operation employment with total manufacturing employment as taken from the U.S. Bureau of the Census, County Business Patterns, the partial correlation analysis results were as in Table 18. There were 26 observations, one for each impacted year between 1965 and 1975 for Jasper, Adams and Beaver counties. Since the first order partial is greater than the zero order partial (simple correlation coefficient) and the significance level of the first order partial is so high, we can interpret these results as indicating that model-derived construction and operation employment explains 29 percent of the variance in total employment.

Again, this provides indirect evidence that our impact modeling assumptions are correct since the correlation between model total employment and actual total employment goes up significantly when manufacturing employment is controlled for. It is also evident that total employment is much more strongly related to manufacturing employment than to our model values. This is expected since manufacturing employment generally makes up a much more significant proportion of the total labor force. However, our analysis still shows that power plant construction (as per our model) has a significant albeit lesser impact on total employment changes.

We also tested this relationship using regression analysis. Here, the actual total employment from County Business Patterns is the dependent variable and services employment, manufacturing employment, and either the predicted model total employment or construction employment were the independent variables. The results are displayed in Table 19. Although service and manufacturing employment changes explain most of the change in total employment, model total and construction employment for power plants contributes significantly to the variance explained. In fact, model employment accounts for approximately 30% of the variation in total employment. This confirms that our model works fairly well in predicting the changes in local employment caused by power plant construction.

Table 18

Partial Correlation Analysis Results

	Correlation Coefficients		
	TOTEMP	MODTOT	MANU
Total Employment (TOTEMP	1.00	.5336	.9992
Model-Derived Employment (MODTOT)		1.00	.5131
Manufacturing Employment (MANU)			1.00

First Order Partial

Controlling for Manufacturing Employement (MANU):

	MODTOT	Significance
Total Employment (TOTEMP)	.5888	.001

Table 19

Regression Results for Actual and Predicted Employment

Dependent Variable - Total Employment, County, Business Patterns
N=26

R^2=.99

Equation 1

Independent Variables	B	Standard Error	F*
Service employment	2.78	0.25	120.34
Model total employment	0.32	0.09	11.35
Manufacturing employment	1.06	0.05	506.7
Constant	484.73		

Equation 2 (same N and R^2)

Independent Variables	B	Standard Error	F*
Service employment	2.83	0.25	124.9
Model construction employment	0.31	0.09	10.2
Manufacturing employment	1.05	0.05	498.5
Constant	519.72		

*All values of F are significant at the 0.05 level

Overall then, this portion of our impact analysis confirms many of the impact assumptions we make at the regional level. In addition, it illustrates the nature and extent of county level impacts vis a vis county population size. Finally, it shows the variation associated with actual impacts caused by the uniqueness of the local situation.

4.3 Impact Analysis, 1975-2000

In this section we estimate employment demands for the planned energy facilities in the seven case study counties, 1975-2000. The basis for these employment estimates are either the projected manpower requirements listed in Environmental Impact Statements for these facilities or the ORBES Labor Impact Model (discussed below). These employment demands are translated into population impacts. The population impacts are the basis for estimating housing, water systems, public expenditure, and county revenue impacts. Each of these impacts is discussed for each case study county.

4.3.1 Projections of Employment Demand

Construction and operation employment demand is estimated for each case study county for the period 1975-2000. The on-line dates and schedules for the power plants in these counties were obtained from the utility companies involved, or specific Environmental Reports and Environmental Impact Statements whenever possible. Otherwise, on-line dates were taken from the Generating Unit Inventory prepared by S. Jansen for ORBES and schedules were derived using the ORBES Labor Impact Model. The sources used for developing employment demands other than the ORBES Labor Impact Model and the ORBES report mentioned above are shown in Table 20.

The ORBES Labor Impact Model was developed to estimate annual labor demands for the construction and operation of planned and scenario-specific generating units in the ORBES region. The annual construction labor demands are derived using manpower per megawatt ratios that vary for the following conditions:

coal unit	with scrubbers,	single unit
coal unit	with scrubbers,	part of multiple unit
coal unit	without scrubbers,	single unit
coal unit	without scrubbers,	part of multiple unit
nuclear unit,	single or part of multiple	

Our ratios are based on actual and expected manpower data available in EIS's, ER's and from the utility companies themselves. These ratios are higher for units with scrubbers than without, lower for parts of multiple units than single units, and higher for nuclear units than any other unit. Scrubbers require additional buildings, equipment and waste disposal areas. Multiple units can share some facilities and infra-structure and therefore can reduce the overall cost per unit. Nuclear units require many highly skilled workers and longer construction periods.

Table 20

Information Sources for Power Plant
Construction and Operation Schedules

County	Report	Information Obtained
Jefferson, Ind.	Marble Hill EIS	Construction and operation employment
Spencer, Ind.	Rockport ER	Construction and operation employment
Adams, Oh.	Killen EIS	Construction and operation employment
	Utility	
Mason, W. Va.	Appalachian Power	Construction and on-line dates for Mountaineer
Jefferson, Ind.	Public Serivce of Indiana	Construction and expected on-line dates for Marble Hill
Jasper, Ill.	Central Illinois Power Service Co.	Construction and expected on-line date for Newton
Spencer, Ind.	Indiana and Michigan Electric Company	Construction and expected on-line dates for Rockport
Trimble, Ky.	Louisville Gas & Electric	Construction and expected on-line dates for Trimble
Beaver, Pa.	Pennsylvania Power	Construction and expected on-line dates for Mansfield

The length of the construction period was also derived from the same information used to develop the ratios. Coal units less than 1000 megawatts were assumed to take 5 years to build, coal units 1000 mw or greater, 6 years and nuclear units, 7 years.

Operation employment demands were also estimated on a per megawatt basis. Again, the same sources were used. The ratios varied for coal units with scrubbers, coal units without scrubbers and nuclear units.

A more complete description of the methods and data sources used to develop the labor demands portion of the ORBES Labor Impact Model is provided in an ORBES memo from Steve Gordon dated June 19, 1979 and in the report by Gordon and Graham (26).

Tables 21 to 27 show the employment demands for each of the case study counties, 1975-2000. The tables exhibit construction and operation employment and total estimated inmigration by year from 1975 to 2000. The figures reflect annual changes in worker demand through the construction period (only some of whom become immigrants) and the final labor force associated with power plant operation (all of whom are assumed to immigrate). These counties exhibit a wide range of construction schedule types. The Rockport plant in Spencer County has a very high peak in construction employment (2,988 workers) with a relatively short duration (6 years for 2 units with total of 2,600 MW). The magnitude of this demand may strain the labor supply for the peak years. This short-lived high demand for workers can strain all the local private and public services. A long construction period with low extended peaks would have quite a different effect from one like that at Rockport. For instance, the Killen plant in Adams County (2 units, total of 1200 MW, 8 year construction period) has a projected construction employment peak of only 400 workers lasting for four years. The prospects of employment lasting for this longer time period is likely to induce a higher percentage of the workers to migrate and to bring their families.

Another variation in schedules is shown by the Newton Plant in Jasper County. Here the construction of three units is lagged over a 12 year period. This 'long-term' demand for workers, again, gives more incentive for construction workers to migrate and to bring their families than a short, high-peaked construction schedule such as Rockport's.

An unusual schedule is shown for Mason County where construction work began in 1974, proceeded for less than six months and was forced to shut down for two years because of a work stoppage. There are many factors that could delay the construction of a power plant, including: materials supply problems, legal constraints, labor supply problems, work stoppage (strikes), accidents and so forth. These are the "unpredictables" associated with power plant development. Any special problems associated with delayed or interrupted construction such as

Table 21

Jasper County Energy Facility Information,

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Newton 1	coal	1977	617
Newton 2	coal	1981	600
Newton 3	coal	1984	600

Year	Total Construction Employment	Operation Employment	Inmigration Total
1975	616	0	68
1976	121	0	12
1977	274	74	101
1978	730	74	174
1979	705	74	145
1980	345	74	109
1981	730	146	219
1982	657	146	212
1983	71	146	153
1984		218	218
1985		218	218
1986		218	218
1987		218	218
1988		218	218
1989		218	218
1990		218	218
1991		218	218
1992		218	218
1993		218	218
1994		218	218
1995		218	218
1996		218	218
1997		218	218
1998		218	218
1999		218	218
2000		218	218

Note: Schedule derived from ORBES Labor Impact Model

Table 22

Jefferson County Energy Facility Information,

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Marble Hill 1 & 2	nuclear	1984	2260

Year	Total Construction Employment	Operation Employment	Inmigration Total
1976	7	ø	1
1977	180	ø	18
1978	923	ø	92
1979	1,820	ø	182
1980	2,154	ø	215
1981	1,864	ø	186
1982	1,023	ø	102
1983	244	ø	24
1984		155	155
1985		155	155
1986		155	155
1987		155	155
1988		155	155
1989		155	155
1990		155	155
1991		155	155
1992		155	155
1993		155	155
1994		155	155
1995		155	155
1996		155	155
1997		155	155
1998		155	155
1999		155	155
2000		155	155

Note: Schedule taken from Marble Hill EIS.

Table 23

Spencer County Energy Facility Information,

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Rockport 1 & 2	coal	1983	2600

Year	Total Construction Employment	Operation Employment	Immigration Total
1977	466		47
1978	756		76
1979	2,225		223
1980	2,988		299
1981	1,819		182
1982	150	165	180
1983		335	335
1984		335	335
1985		335	335
1986		335	335
1987		335	335
1988		335	335
1989		335	335
1990		335	335
1991		335	335
1992		335	335
1993		335	335
1994		335	335
1995		335	335
1996		335	335
1997		335	335
1998		335	335
1999		335	335
2000		335	335

Note: Schedule taken from Rockport Environmental Report

Table 24

Trimble County Energy Facility Information

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Trimble 1	coal	1984	495
Trimble 2	coal	1985	495
Trimble 3	coal	1992	675
Trimble 4	coal	1999	675

Year	Total Construction Employment	Operation Employment	Immigration Total
1979	47		5
1980	318		32
1981	993		99
1982	1,372		137
1983	720		72
1984	70	69	76
1985	Ø	138	138
1986	Ø	138	138
1987	64	138	144
1988	370	138	175
1989	485	138	237
1990	886	138	227
1991	96	138	148
1992	Ø	232	232
1993	Ø	232	232
1994	64	232	238
1995	370	232	269
1996	985	232	331
1997	886	232	321
1998	96	232	242
1999	Ø	326	326
2000	Ø	326	326

Note: Schedule derived from ORBES Labor Impact Model

Table 25

Adams County Energy Facility Information,

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Killen 1 & 2	Coal	1985	1200

Year	Total Construction Employment	Operation Employment	Immigration Total
1977	130	ø	13
1978	300	ø	30
1979	400	ø	40
1980	400	ø	40
1981	400	ø	40
1982	400	ø	40
1983	250	ø	25
1984	250	ø	25
1985		150	150
1986		150	150
1987		150	150
1988		150	150
1989		150	150
1990		150	150
1991		150	150
1992		150	150
1993		150	150
1994		150	150
1995		150	150
1996		150	150
1997		150	150
1998		150	150
1999		150	150
2000		150	150

Note: Schedule taken from Killen EIS

Table 26

Beaver County Energy Facility Information
Power Plant Employment and Inmigration 1975-2000

Plant		Type	On-Line Date	MW
Mansfield	1	coal	1976	917
Mansfield	2	coal	1977	917
Mansfield	3	coal	1980	917
Beaver Valley	1	nuclear	1978	885
Beaver Valley	2	nuclear	1984	885

Year	Total Construction Employment	Operation Employment	Inmigration Total
1975	2,365	0	118
1976	1,143	192	249
1977	1,513	384	460
1978	1,710	463	549
1979	1,143	463	520
1980	1,256	655	718
1981	943	655	702
1982	511	655	681
1983	92	655	660
1984		734	734
1985		734	734
1986		734	734
1987		734	734
1988		734	734
1989		734	734
1990		734	734
1991		734	734
1992		734	734
1993		734	734
1994		734	734
1995		734	734
1996		734	734
1997		734	734
1998		734	734
1999		734	734
2000		734	734

Note: Schedules derived from ORBES labor impact model

Table 27

Mason County Energy Facility Information,

Power Plant Employment and Inmigration 1975-2000

Plant	Type	On-Line Date	MW
Mountaineer	Coal	1981	1300

Year	Total Construction Employment	Operation Employment	Immigration Total
1974	104	ø	10
1975	ø	ø	ø
1976	ø	ø	ø
1977	594	ø	59
1978	1,583	ø	158
1979	1,424	ø	142
1980	154	ø	15
1981		156	156
1982		156	156
1983		156	156
1984		156	156
1985		156	156
1986		156	156
1987		156	156
1988		156	156
1989		156	156
1990		156	156
1991		156	156
1992		156	156
1993		156	156
1994		156	156
1995		156	156
1996		156	156
1997		156	156
1998		156	156
1999		156	156
2000		156	156

Note: Schedule derived from ORBES Labor Impact Model and Information gained from APPC as to the work stoppage 1974-1977

the effect of increased labor and supply costs, cannot be covered here since these problems would be specific to the particular situation. The specifics for the Mountaineer plant in Mason County, other than the years of construction, were not available to us so we can only address the direct effects of a break in the schedule.

Just how these various schedules are translated into population changes and housing, public service, public expenditures and county revenue impacts is discussed in the remainder of this chapter.

4.3.2 Population Impacts

Once the direct labor requirements have been established for the construction and operation of an energy facility, we must then proceed to determine how many of these workers will migrate and how many will commute to that county. The number of inmigrants is an important variable for estimating housing and public service impacts discussed in the following sections of this chapter. We will review the assumptions used in estimating the number of migrants and the derived figures for each case study county.

The number of inmigrants is computed as part of the ORBES Labor Impact Model. The percentage of workers that migrate is assumed to vary directly with the distance between the case study county and the nearest SMSA county. The percentages of migrating workers related to distance were derived from the TVA and other monitoring studies cited in Chapter 2.0. A test of these assumptions in year one of ORBES showed them to be good relative indicators of migration impacts consistent with the available data. Distances were measured from centroid to centroid. SMSA counties were assumed to attract only 5% of the construction workforce as inmigrants, counties within 50 miles of an SMSA, 10%, and counties greater than 50 miles away, 30%. All operation and maintenance workers are assumed to migrate to the county. Refer to Tables 21 to 27 for lists of the number of inmigrant workers for each case study county, 1975 to 2000.

Beaver County, the only SMSA county in our case study group, shows only 5% of the construction workforce migrating (see Table 26) and 100% of the operating workers. We must note that the inmigration totals on these tables is for workers only. Since some of these workers, the operation workers particularly, will bring their families with them, the actual number of inmigrants would be approximately from 1.8 to 2.2 times as great.

The rest of the case study group, Jasper, Jefferson, Spencer, Trimble, Adams, and Mason Counties, are all within 50 miles of an SMSA. The ten percent migration figure was used for those counties. Using the conservative figure of 1.8 persons per family, we estimated the population impact of the power plant workers on each county. These are

listed on Table 28. Also listed is the percentage of the county's 1975 population that the immigrants represent. In only Trimble County, Kentucky, does this percentage go above 3.5%, and this occurs past 1980 when the base population would be greater. The peak percentage of immigrants to 1975 population reaches 10.6% for Trimble County, however, the peak is reached in gradual increments from 1979 to 1996. In Beaver County the percentage never goes above .6%. This information seems to indicate that the number of immigrants for any county will cause no great influx of people relative to the base population.

Numbers of immigrants alone are not a sufficient indication of the related impacts in housing, public services and county revenues and expenditures. Each of these impact areas are covered in the following sections.

4.3.3 Housing Impacts

One of the most significant impacts resulting from power plant construction is the demand placed on the local housing stock by immigrants. This demand can create a strain on the existing market and thereby increase housing costs. Housing impacts are estimated for each of the case study counties based on the number of construction and operation employees expected to migrate and an estimate of the rate of building new housing.

Very little housing data exists outside the decennial census. Using the 1960 and 1970 Census of Housing data we derived an annual new building rate for each case study county. By comparing this annual building rate with the additional demand created by migrating power plant workers we can get some idea concerning a potentially strained housing market. These figures are listed on Table 29.

We assume that an additional demand comprising more than 50 percent of the historical growth rate will create a significant impact on the housing stock. Five out of the seven case study counties appear to have at least one year with potential housing shortage problems. In Jasper County the additional housing demand exceeds 50 percent of the building rate for four years - 1975, 1977, 1978, and 1981. For Spencer County this situation exists in 1979 and 1980.

In Trimble County 50 percent of the building rate is exceeded six times, 1980-1982, 1988-1989, 1996. In Adams County, where the construction schedule had very low peaks over a long duration, the rate is exceeded only in 1985, the on-line date of the Killen plant. The operation workers are assumed to move to the host county. For Killen, the largest number of inmigrants is associated with the start of the operations phase of the plant. In Mason County, housing shortages are possible in 1978. The consequences of such demands can be both positive and negative. They may be negative in the sense that construction workers with higher salaries than most local residents can bid up the prices for housing. They might also choose to live in temporary

Table 28

Total Inmigration, Including Families and Percentage of 1975 Population
Case Study Counties, 1975-2000

	Jasper County		Jefferson County		Spencer County	
	Inmigrants with Families	As a % of 1975 Population	Inmigrants with Families	As a % of 1975 Population	Inmigrants with Families	As a % of 1975 Population
1975	122	1.1	0	0	0	0
1976	22	0.2	2	0.1	0	0
1977	182	1.6	32	0.6	85	0.5
1978	313	2.8	166	1.2	137	0.8
1979	261	2.3	328	1.4	401	2.3
1980	196	1.8	381	1.2	538	3.1
1981	394	3.5	335	0.7	328	1.9
1982	382	3.4	184	0.2	324	1.8
1983	275	2.5	43	1.0	603	3.4
1984	392	3.5	279	1.0	603	3.4
1985	392	3.5	279	1.0	603	3.4
1986	392	3.5	279	1.0	603	3.4
1987	392	3.5	279	1.0	603	3.4
1988	392	3.5	279	1.0	603	3.4
1989	392	3.5	279	1.0	603	3.4
1990	392	3.5	279	1.0	603	3.4
1991	392	3.5	279	1.0	603	3.4
1992	392	3.5	279	1.0	603	3.4
1993	392	3.5	279	1.0	603	3.4
1994	392	3.5	279	1.0	603	3.4
1995	392	3.5	279	1.0	603	3.4
1996	392	3.5	279	1.0	603	3.4
1997	392	3.5	279	1.0	603	3.4
1998	392	3.5	279	1.0	603	3.4
1999	392	3.5	279	1.0	603	3.4
2000	392	3.5	279	1.0	603	3.4

Table 28 (Cont'd)

	Trimble County		Adams County	
	Inmigrants with Families	As a % of 1975 Population	Inmigrants with Families	As a % of 1975 Population
1975				
1976				
1977				
1978			23	0.1
1979			54	0.2
1980	9	0.2	72	0.3
1981	58	1.0	72	0.3
1982	178	3.2	72	0.3
1983	247	4.4	72	0.3
1984	130	2.3	45	0.2
1985	137	2.4	45	0.2
1986	248	4.4	270	1.2
1987	248	4.4	270	1.2
1988	259	4.6	270	1.2
1989	315	5.6	270	1.2
1990	427	7.6	270	1.2
1991	409	7.3	270	1.2
1992	266	4.7	270	1.2
1993	418	7.4	270	1.2
1994	418	7.4	270	1.2
1995	428	7.6	270	1.2
1996	484	8.6	270	1.2
1997	596	10.6	270	1.2
1998	578	10.3	270	1.2
1999	436	7.8	270	1.2
2000	587	10.5	270	1.2
	587	10.5	270	1.2

Table 28 (Cont'd)

	Beaver County		Mason County	
	Inmigrants with Families	As a % of 1975 Population	As a % of with Families	As a % of 1975 Population
1975	212	0.1	106	0.4
1976	448	0.2	284	1.1
1977	828	0.4	256	1.0
1978	988	0.5	27	0.1
1979	936	0.4	281	1.1
1980	1292	0.6	281	1.1
1981	1264	0.6	281	1.1
1982	1226	0.6	281	1.1
1983	1188	0.6	281	1.1
1984	1321	0.6	281	1.1
1985	1321	0.6	281	1.1
1986	1321	0.6	281	1.1
1987	1321	0.6	281	1.1
1988	1321	0.6	281	1.1
1989	1321	0.6	281	1.1
1990	1321	0.6	281	1.1
1991	1321	0.6	281	1.1
1992	1321	0.6	281	1.1
1993	1321	0.6	281	1.1
1994	1321	0.6	281	1.1
1995	1321	0.6	281	1.1
1996	1321	0.6	281	1.1
1997	1321	0.6	281	1.1
1998	1321	0.6	281	1.1
1999	1321	0.6	281	1.1
2000	1321	0.6	281	1.1

Table 29

Annual Building Rate and Housing Demand for Case Study Counties 1975-2000

County	Annual Building Rate	Additional Demand Created by In-migrating Workers	
		Year	Number of Units
Jasper	61	1975	68
		1977	33
		1978	46
		1981	72
Jefferson	214	1976	1
		1977	17
		1978	74
		1979	90
		1980	33
Spencer	114	1977	47
		1978	29
		1979	147
		1980	76
		1983	36
Trimble	45	1979	5
		1980	27
		1981	67
		1982	38
		1985	1
		1987	6
		1988	31
		1989	62
		1994	1
		1995	3
		1996	62
Adams	94	1977	13
		1978	17
		1979	10
		1985	110
Beaver	909	1975	118
		1976	131
		1977	211
		1978	89
		1980	169
		1984	16
Mason	162	1974	10
		1977	49
		1978	99

Source: U.S. Bureau of the Census, 1970 Census of Housing.

housing such as trailers which may be perceived as a negative impact by some local residents. On the other hand, the new demands could mean increased local employment in the construction and service industries. The additional payroll of the power plant construction will bring some positive economic benefits. The extent to which these negative and/or positive effects will occur depends on local perceptions and individual decisions which are impossible to predict.

4.3.4 Public Water Systems Impacts

Increased housing demands generate associated infrastructure demands such as sewer and water services. Based on information obtained from the U.S. Bureau of the Census and state agencies dealing with these services, we have attempted to evaluate the potential demand/supply situations which could exist in the case study counties with the development of energy facilities as planned.

Many rural counties in the ORBES region have little or no public sewer systems. Public water systems are more abundant but they often serve only 50% of the housing units. (See Table 4). Existing water and sewer systems can have consumption or use levels which are very near the design capacity of the plant. Inmigration could severely strain the systems in this case forcing a decline in the quality and quantity of service available to all customers, or causing the public outlay of funds to expand or improve their system. In some counties, an increase in the number of septic tank systems could severely effect the local water quality.

Information concerning local water systems is often available from the state department of Natural Resources or the state EPA. The data usually includes population served, treatment plant capacity, pumping station capacity, daily consumption, and others. Interpretation of this information can be difficult. Data on local water systems were collected for the case study counties using the references listed in Appendix A. Local consumption and capacity figures were summed to the county level. We then compared consumption with capacity. At the county level, there appears to be a great excess of water capacity. We further examined other ORBES Ohio counties for this excess and found this excess to be the rule rather than the exception. One of the reasons for this may be that the consumption figures used are 'average daily use' rather than 'peak daily use'. We must also note that summing across local systems to the county level overlooks the potential strain on an individual system. For example, a few local systems within the case study counties are relatively close to capacity. The New Haven-Hartford-Mason service area in Mason County was reported as having a daily excess of 20,000 gallons per day. Using the 'rule of thumb' estimate of 100 gallons of water required per person per day, this water system could handle only 200 additional residents. The Cresville Heights water system in Beaver County serves approximately 10,500 users with .85 mgd capacity. These figures indicate that, at capacity, only

81 gallons per day is available per person (well below the 'rule of thumb'). An influx of new users would further reduce the amount of water available per person for all users in this local service area.

A great deal of variation in water consumption per capita was evident for the case study counties and the Ohio ORBES counties. This variation could be due to differences in the availability of sewer services, the number of seasonal or temporary users (state parks, colleges) or other reasons. Overall, it appears that problem areas of water supply shortages associated with demand created by inmigrating power plant workers will be localized and difficult to predict, both in location and severity of impact.

4.3.5 Tax Impacts

One of the major local benefits of an energy facility can be its impact on property tax receipts. Most plants receive a very high assessed valuation and as such, comprise a large proportion of the tax base. Thus, we had originally hoped to analyze tax benefits and public service costs in some detail as a part of our case study analysis. Unfortunately, little tax information was made available to us either by the utility companies or by the local or state government agencies responsible for taxes. Thus, we have had to utilize the limited information available to estimate the local tax impacts of power plants.

Information that was reviewed includes state tax laws, environmental impact statements, and related socioeconomic impact studies. Appendix A shows the EIS's from which information was obtained. The property tax laws in each of the six states is different, although they are parallel. Differences come in what is considered taxable as real property, the revenues from which local and county governemnts are supported, and what is taxed in other categories, the revenues from which the state draws part of its income. We are interested in this case in only the first quantity. Accordingly, we searched for information on assessed values of power plant sites over time.

From the limited information available, we found that the assessed values of a coal fired power plant ranged from $39,500,000 to $94,809,000. On a per megawatt of nameplate capacity basis, data from four plants yielded assessed values per MW of $40,385, $49,899, $64,233, and $70,876. The average of these is approximately $56,000/MW.

We also found that the plant is only taxed at this valuation the year following the completion of construction. All states have a provision for assessment during construction. In West Virginia, this assessment is based on the cost of construction materials, while in the other states it is a function of the value of the land and partially completed buildings. In many areas, the local assessor will not make an assessment on the buildings until the third or fourth year of construction. Whether or not this will occur will depend on the

individual assessor and is impossible to predict. Our first set of calculations was done assuming that an assessment was made each year of construction. From the scanty data we had available, the percentage of the assessment charged by year of construction is assumed to be 0.2% after the first year, 0.43% after the second, 7.0% after the third, 50% after the fourth, 100% after the fifth (19.20). For tax purposes, depreciation is assumed to be allowed at 3%/year following the completion of the plant. This is in congruence with state tax laws.

Expenditure estimates are made using the average per capita cost for all local services derived from the Census of Governments (21). Figures were derived for each of the case study counties. They were found to be quite variant when looked at over time. Thus, the state average per capita cost were assumed to be a more representative number.

Obviously, calculations performed using these assumptions will not give exact results. However, we believe that the numbers used are representative of the average trends in tax revenues and expenditures over time and will thus give good "ball park" estimates. The most complete, local information available is for Jasper County, Illinois. Using the ORBES Labor Impact Model, we derived the number of inmigrants to the county over time. Additional expenditures were calculated using an average family size of 1.8 persons per family and the average state per capita annual services cost of %527. Revenues were calculated based on the 1975 tax rate of 4.12% multiplied by the current plant assessed value calculated according to the assumptions listed above.

Results of these calculations are shown in Table 30. Here, one can see that there are several potential impacts of the power plant location. First, one can see that in the short run, namely the first two years of construction, revenues will be less than the cost of additional service demands. Second, we can see that in the longer run, the plant will bring a tremendous net benefit in terms of revenues. These monies could be applied to improving services or to reducing the overall tax rates. This second impact is calculated in the last column of the table. Probably, a combination of the two effects will occur. We must also note that these calculations are for Jasper County as a whole. Settlement of additional construction or operation personnel in other localities would mean that those localities would have to absorb the additional costs without any tax benefits.

Overall, the tax impacts of a power plant can be summarized as follows:

1) Net, long term tax benefits to the taxing district and county in which the plant is located.
2) Tax benefits result in the ability of the community to either increase service levels or decrease tax rates.
3) There is a short term deficit in the amount of taxes collected versus service costs. This would be exacerbated if the local assessor delays in making an assessment as has happened

Table 30

Estimated Jasper County Tax Impacts

Year	Total Plant Assessed Value (1000's $)	Revenues @ 4.12% 1000's $	Increased Expenditures @ 1.8 %/Person Family	Total New County Assessed Value	New Tax Rate
1974	69	2.84	18.84	58678	4.15
1975	149	6.13	64.05	58758	4.22
1976	2418	99.62	11.30	61027	3.98
1977	17276	711.77	95.13	75885	3.31
1978	34619	1426.30	138.45	93228	2.74
1979	33659	1386.75	136.57	92268	2.77
1980	34852	1435.90	102.67	93461	2.69
1981	48402	1994.16	102.66	107011	2.35
1982	64333	2650.52	206.27	122942	2.13
1983	64615	2662.14	199.68	123224	2.12
1984	77195	3180.43	144.11	135704	1.89
1985	92183	3797.94	205.33	150792	1.74
1986	89418	3684.02	205.33	148022	1.77
1987	86735	3573.48	205.33	145344	1.80
1988	Declines to	Declines to	Stable to		
1989	end of period	end of period	end of period		
1990					
1991					
1992					
1993					
1994					
1995					
1996					
1997					
1998					
1999					
2000					

in the past.

4) There is a possibility of a geographic disparity in tax revenues versus service costs related to the degree to which inmigrants settle outside the taxing districts benefiting from plant tax revenues.

We might conclude, then, that overall, the local tax benefits of a power plant are significant and positive, but that some policies might be required to offset disparities in time or geographic distribution of revenues.

5.0 Classification of Case Study Counties for Impact Evaluation

As was mentioned above, each of the case study counties was selected to represent a range of socioeconomic and environmental characteristics representative of all candidate counties in the region. In order to test the generalizability of our results, we derived a taxonomy of all candidate counties in the region.

This chapter reviews the taxonomies used by other researchers for a similar purpose. It then goes on to discuss a few of the problems associated with generalization in socioeconomic impact analysis. Finally, the classification we derived is presented in detail.

5.1 Classification in Other Studies

Several of the studies cited in the introduction to this report have sought to use classification as a way to generalize from specific county information to overall regional impacts. The basic underlying assumption made in doing this is that counties with similar demographic, economic, and social attributes will have similar propensities to be impacted - in both a positive and a negative way. For example, counties with large populations are generally assumed to easily absorb any population influx which might occur during power plant construction. In contrast, counties with few people are assumed to be more heavily impacted.

With this type of assumption in mind, researchers at Argonne National labs acted three primary factors influencing socioeconomic impacts:

> The timing and relative magnitudes of the employment requirements associated with the energy facility;
> The economic characteristics of the local impact area; and
> The sociodemographic characteristics of the impact county (17, p.8-8).

Accordingly, they classified all of their candidate counties in relation to four variables:

1) Population density at the time of impact;
2) Population density of the county and surrounding areas;
3) Distance in miles to the nearest regional trade center;
4) Relationship between basic and secondary employment.

These criteria were used to evaluate the impact potential for all counties that were potential sites for coal development. A multivariate Euclidean Distance algorithm was used to put counties into one of three groups. The first group includes counties with "a high probability of adverse socioeconomic impact from energy development." (17, p. 8-16). The second group has moderate assimilative capacities and therefore less chance of adverse impacts. The third group can accomodate large increases in coal development without major impacts.

A similar classification was performed in a related study by Oak Ridge National Laboratory (22). They classified counties into impact groups based on the potential annual growth rate for population as shown in Table 31.

Table 31

Oak Ridge National Lab Indicator of Social Impact

Annual Growth Rate	Probability of Social Impacts
Less than 5%	Low
5% to 15%	Moderate
More than 15%	High

Source: Ref. 22, p. 9-18.

This is analagous to the population density variables of ANL. Oak Ridge researchers also derived an index of service impacts. They used factor analysis to derive a linear weight associated with each of six variables: population, percent of the population in urban places, median family income, whether the county in a Standard Metropolitan Statistical Area (SMSA), population density, and retail-wholesale-service trade. Using the weights they calculated an index of service base capacity:

$$I_j = \sum_{i=1}^{6} [W_i \left(\frac{X_{ij} - X_i}{Sd_i}\right) + k] \, 100$$

where I_j = the index value for county j

W_i = weight of the ith variable, i = 1, 6

X_{ij} = the level of the ith variable in the jth county

X_j = the mean value for the ith variable

Sd_i = the standard deviation

X = a constant to make the index value equal to 100

k = when all variables take the mean value
(22, p. 9-35,36)

The two studies cited above both indicate that a major problem associated with socioeconomic impact analyses to date is the scanty information with respect to the causes and effects of such impacts. As was pointed out in the introduction to this report, few studies have been completed which trace actual socioeconomic impacts through time. Thus, predictions of impact are based on generalizations from these studies and many assumptions made by various researchers.

The implications of these scanty data are that the level of generalizations made, especially in regional studies, must be very high. Thus, researchers at the two National Labs only derived three groups of impact counties.

It is clear however from the few monitoring studies that have been made that the variation in socioeconomic impacts associated with power plants is very great. Variations in many individual plant and community characteristics may mean that two communities which are almost equal in population size, population density, and income may have quite different actual impacts.

The question which remains is whether other available data would increase the probability of correctly identifying potential impacts. Is it possible to refine the generalizations that have been made in previous studies in order to make more explicit statements about socioeconomic impacts? The remainder of this chapter discusses a test of such a data set.

5.2 Classification of ORBES Candidate Counties

In an attempt to place our own case study counties into groups about which some socioeconomic impact generalizations might be made, we derived a taxonomy of our candidate counties in a manner parallel to those cited above.

First, we assembled a data set which would represent a large array of potential socioeconomic impact indicators. These included variables on population, housing, income, employment, and natural resources. Table 32 lists the variables used in the final analysis. Here, one can see that the variables represent a much broader and more specific set of indicators of the socioeconomic impacts of energy facilities than did those used in previous studies.

The data were separately input to two analyses in order to classify the candidate counties into groups based on the potential for socio-economic impact. In the first analysis, the variables were first grouped using factor analysis. This was necessary in order to reduce the redundancy in the data set and because the next algorithm used assumed that the data used were statistically independent. The factor scores from the factor analysis represent such an independent data set.* The second algorithm used was the H-GROUP program (23). It is basically a Euclidean Distance-based clustering technique. The final result was a grouping of ORBES candidate counties into four groups. The groups will be described below.

---

*For a complete review of factor analysis and classification, the reader is referred to Abler et al. (24) and Rummel (25).

Table 32

Variables Used in the Taxonomy of Candidate Counties

Variable Type	Variable	Source	Comments
Population	Total 1970 Population	1970 Census	
	Net Migration 1970-76	1970 Census and Census Estimates	
	Dependency Ratio	Derived from Census	Population 0-14+ 65 and Over Divided by Population 15-64
	Total Urban Population	1970 Census	
	Population Density 1975	1975 Census Population Estimates	
Income	Median Family Income	1970 Census	
	% Families Below Poverty Level	1970 Census	
	% Persons on Public Assistance - Aid to Dependent Children	City and County Data Book, 1972	
	% Persons on Public Assistance - Old Age	City and County Data Book, 1972	
	Median Effective Buying Income	Sales Management, 1975	
Housing	% of Housing Units Built Before 1939	1970 Census	Measure of Housing Age
	% of Housing Units Built 1960-70	1970 Census	
	% of Housing Units with Public Water		Measure of Service
	% of Housing Units with Public Sewer		Measure of Service
	% of Housing Units Vacant Year Round		Measure of Vacancy
	Total Housing Units		
	% Housing Units Lacking Some Plumbing		Measure of Housing Quality
	% Housing Units with 71.51 Persons per Room		Measure of Crowding
Employment	Total Employment 1970	1970 Census	
	% Workers Employed in Agriculture	1970 Census	
	% Workers Employed in Services	1970 Census	
	% Workers Employed in Mining	1970 Census	
	% Workers Employed in Manufacturing	1970 Census	
	% Workers Employed as Craftsmen	1970 Census	
Natural Resources	% Land in Forest		

A second method of grouping was tested in order to get a measure of the efficiency of the first method. Here, the original variables were input to a discriminant analysis program. The groups derived using the first procedure were input as well. The discriminant analysis program derived three linear discriminant functions (very analagous to the factor analysis functions) and tested the ability of the functions to correctly classify the candidate counties. Only seven of the 114 counties were found incorrectly classified. After changing these seven to the correct group, the analysis was repeated. The resulting new discriminant functions placed 96% of the counties into the correct group.

Putting the technical aspects of these analyses aside, this means that based on either approach to classification, the vast majority of the counties were placed into groups which represent their differences with respect to the socioeconomic variables. Theoretically then, these groups whould be distinct enough to discern differences in potential socioeconomic impacts.

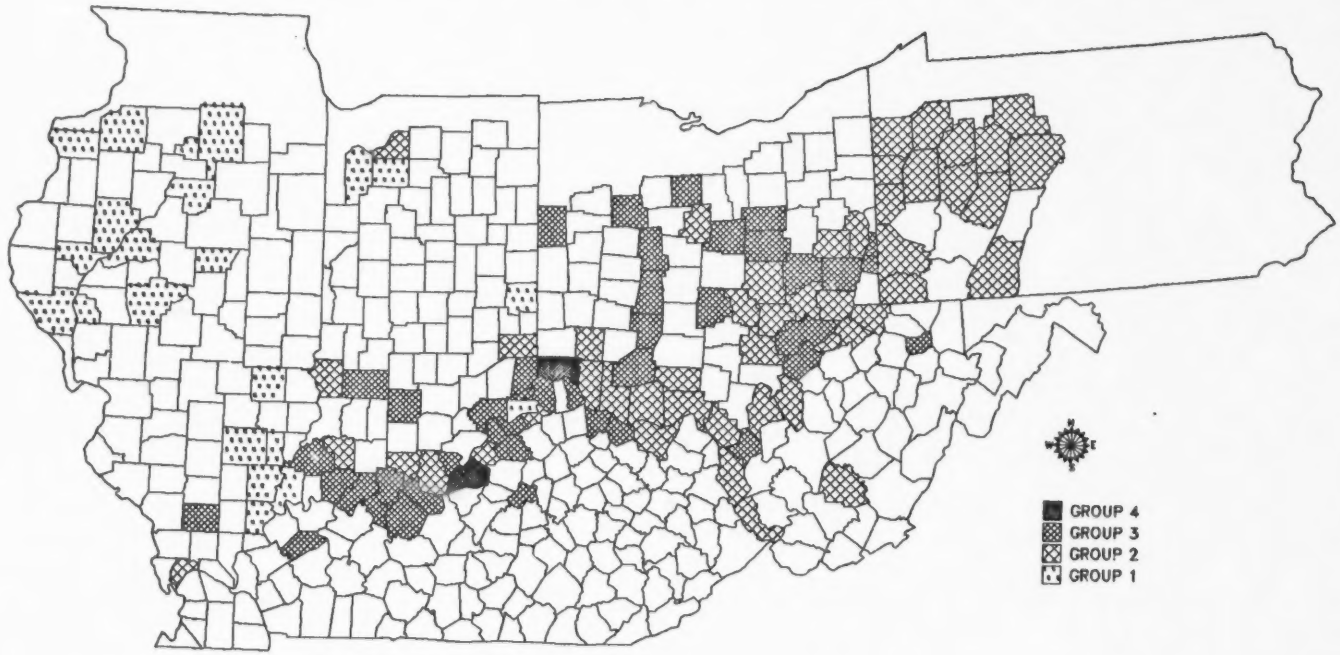
Figure 3 shows a map of the ORBES region with the four county impact groups. Table 33 shows the statistical breakdown of the groups with respect to each of the original variables. What becomes immediately apparent is that the values of the variables for some of the members of each group overlap with values for the other groups. The mean values are generally different but the range around the mean indicates this overlap. The implication of this is that the classification does not yield a distinct set of counties where socioeconomic impacts will be the same.

An example will serve to illustrate the difficulty one encounters. If one uses the mean housing vacancy rate as an indicator of housing impacts, group 1 counties would have the highest probability of impact because they have the lowest vacancy rate at 6.5%. Groups 3 and 4 would be about equal at 7.2% and group 2 would be the "best" at 8.1%. Yet, if we look at the range or minimum and maximum we see that one county in group 1 has a rate of 13.0% while one in group 2 has a rate of 2.8% Even though the classification algorithms work efficiently in statistical terms, averaging characteristics over an array of variables yields a grouping which is difficult to interpret for impact analysis. This same problem must have arisen in previous studies but was not reported. Thus, the generalizations made here and in those studies are subject to so many exceptions as to make them meaningless.

It becomes apparent that the degree of generalization must be relaxed. One way of doing this is to perform separate taxonomies using the separate groups of variables - housing, population, income, and employment. The resulting classifications will still yield some exceptions to the generalizations that are made. However, more discrete groups should form making the interpretation for impact analysis easier.

Figure 3

COUNTY IMPACT GROUPS USING
ALL VARIABLES



PREPARED FOR OHIO RIVER BASIN ENERGY STUDY
BY CAGIS/UICC, MARCH, 1980

Table 33

Descriptive Statistics on Groupings Derived Using All Variables

Variable	Group 1 N=22 Mean	Group 1 N=22 Range	Group 2 N=48 Mean	Group 2 N=48 Range	Group 3 N=42 Mean	Group 3 N=42 Range	Group 4 N=2 Mean	Group 4 N=2 Range
% Older Houses	62.9	26.2	60.0	45.4	58.2	58.8	40.0	10.8
% New Houses	15.8	10.6	16.0	23.1	19.2	32.8	24.5	4.6
% Houses Served by Public Sewers	46.9	58.5	38.0	64.9	47.8	83.9	85.2	15.5
% Houses Vacant	6.5	10.2	8.2	16.0	7.2	8.7	4.8	0.5
% Lacking Some Plumbing	12.3	26.6	18.2	47.0	15.2	33.0	3.4	0.6
% Families Below Poverty	11.2	11.4	15.6	30.5	12.3	31.2	8.6	0.6
% Net Migration '70-'76	1.6	23.5	3.5	35.8	2.2	25.1	-7.0	3.3
Dependency Ratio	71.2	15.0	68.2	40.9	68.3	23.9	63.7	1.7
Total Urban Population (1000's)	8.0	120.8	18.7	159.6	16.2	77.0	773.0	230.1
Total Population (1000's)	31.1	156.3	49.1	206.7	34.0	102.6	809.5	229.0
Median Family Income	8463.0	3418.0	7667.6	5746.0	8099.3	4890.0	10153.0	667.0
Total Employment (1000's)	11.4	57.3	16.4	73.6	12.3	36.3	311.2	85.1
% Manufacturing Workers	24.0	28.3	32.0	50.2	32.4	27.9	32.3	0.4
% Agricultural Workers	15.3	24.6	5.3	16.5	8.2	26.4	0.5	0.1
% Mining Employees	2.3	11.9	4.4	24.2	1.9	11.3	0.1	0.1

Sources: 1970 Census of Population and Housing and
1976 Population Estimates of Bureau of the Census

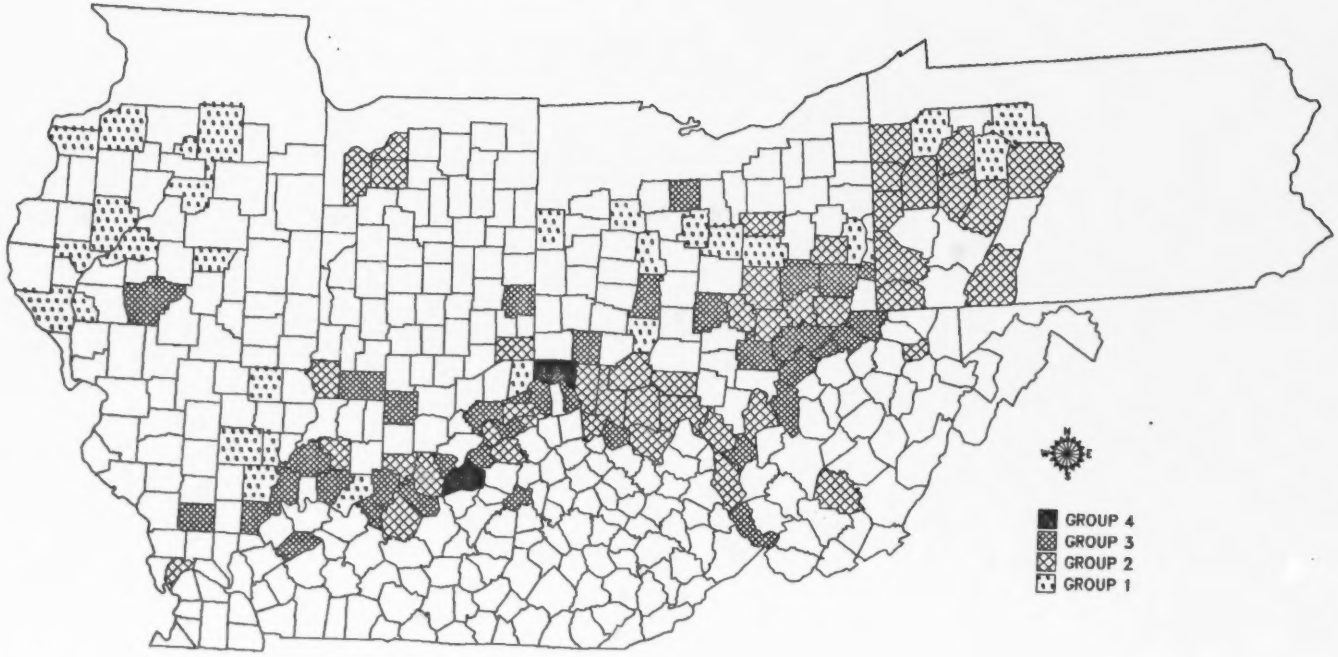
Figures 4 to 7 show the results of the separate classifications using the separate sets of variables. Here, one can see that the groupings change significantly depending on the set of variables being analyzed. Table 34 summarizes the differences in the groups for each variable set . One should note that group 4 is always only two rather unique counties - Jefferson County, Ky. (Louisville); Hamilton County, Ohio (Cincinnati).

A complete discussion of the groupings is given in another report (26). For now, we will point out where our case study counties fall. This is shown in Table 35. As one can see, the case studies come from a range of groups. The group membership changes for some of the counties as one goes from one variable set to another. Table 36 summarizes what are the characteristics of the groups in terms of the probability of impacts.

If we compare Tables 35 and 36, we can derive the set of expected impacts associated with power plant development in the case study areas. These can then be compared to our findings based on actual data. We do not expect that these results will be absolutely clear cut. However, we would expect that the expected impacts would put us in the right "ball park". If it does not, we must restrict our regional generalizations. If we are correct, we can make our generalizations with more confidence. Such a comparison will be drawn in the final chapter of this report.

Figure 4

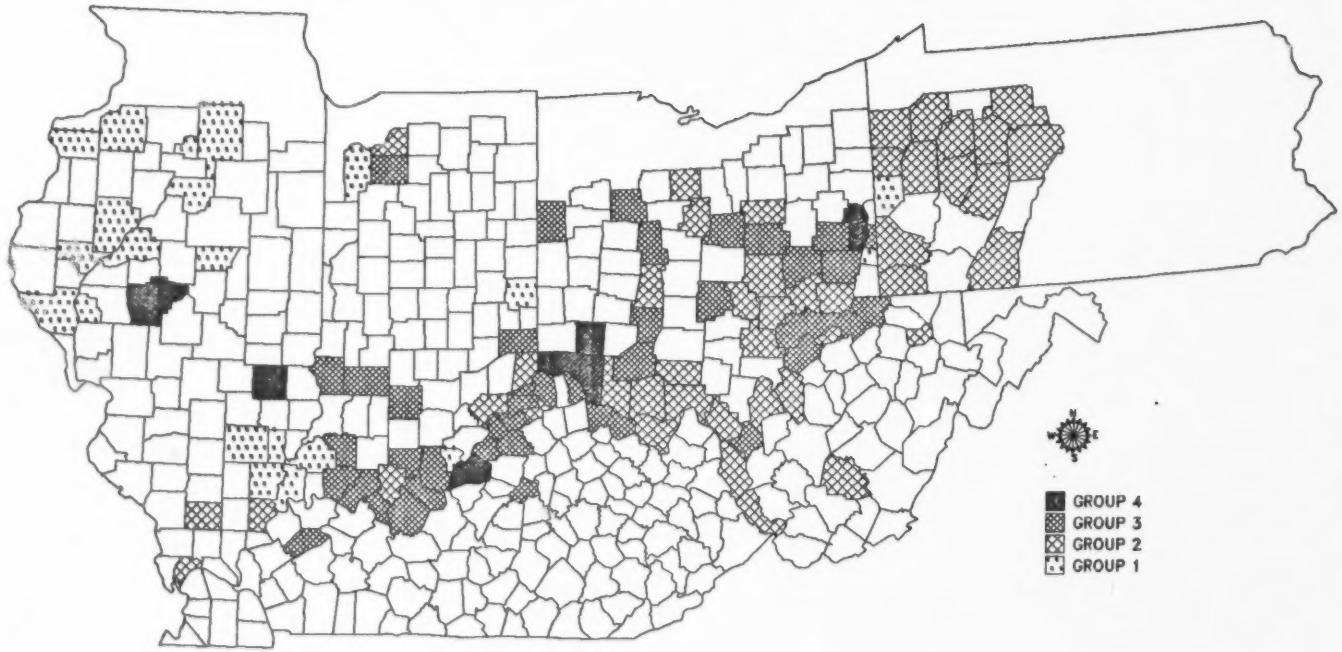
COUNTY IMPACT GROUPS USING
INCOME VARIABLES



PREPARED FOR OHIO RIVER BASIN ENERGY STUDY
BY CAGIS/UICC, MARCH, 1980

Figure 5

COUNTY IMPACT GROUPS USING EMPLOYMENT VARIABLES

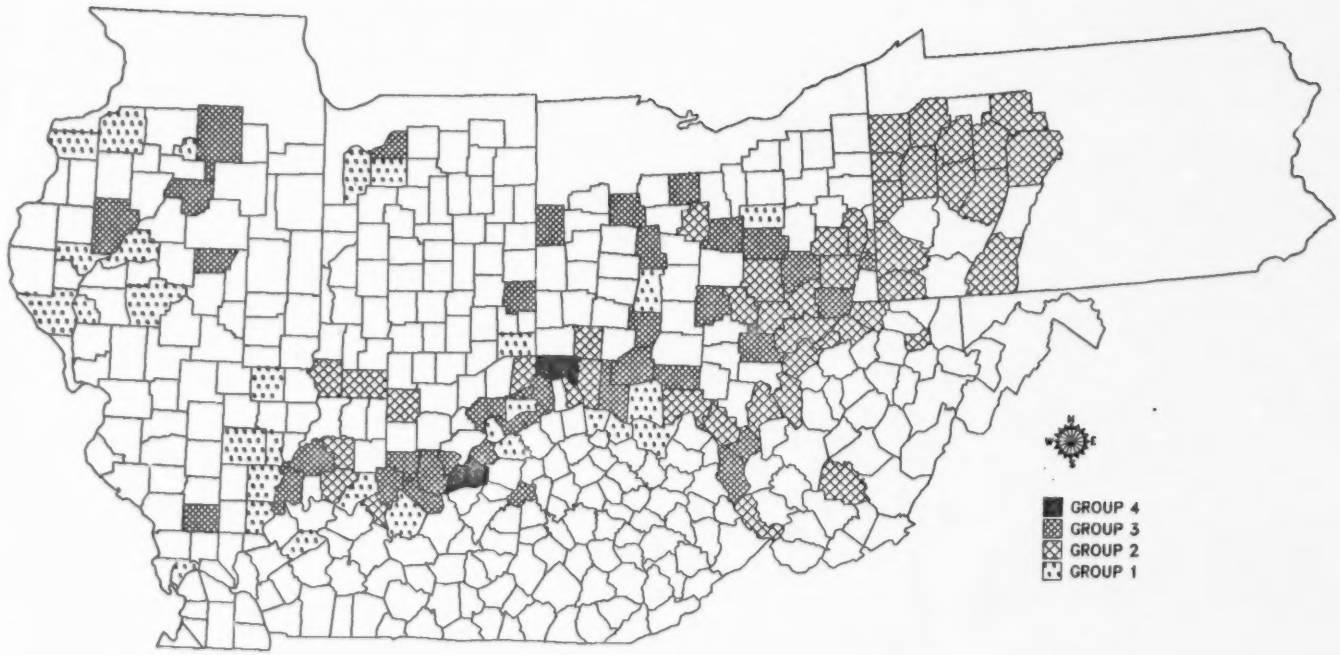


PREPARED FOR OHIO RIVER BASIN ENERGY STUDY

BY CAGIS/UICC, MARCH, 1980

Figure 6

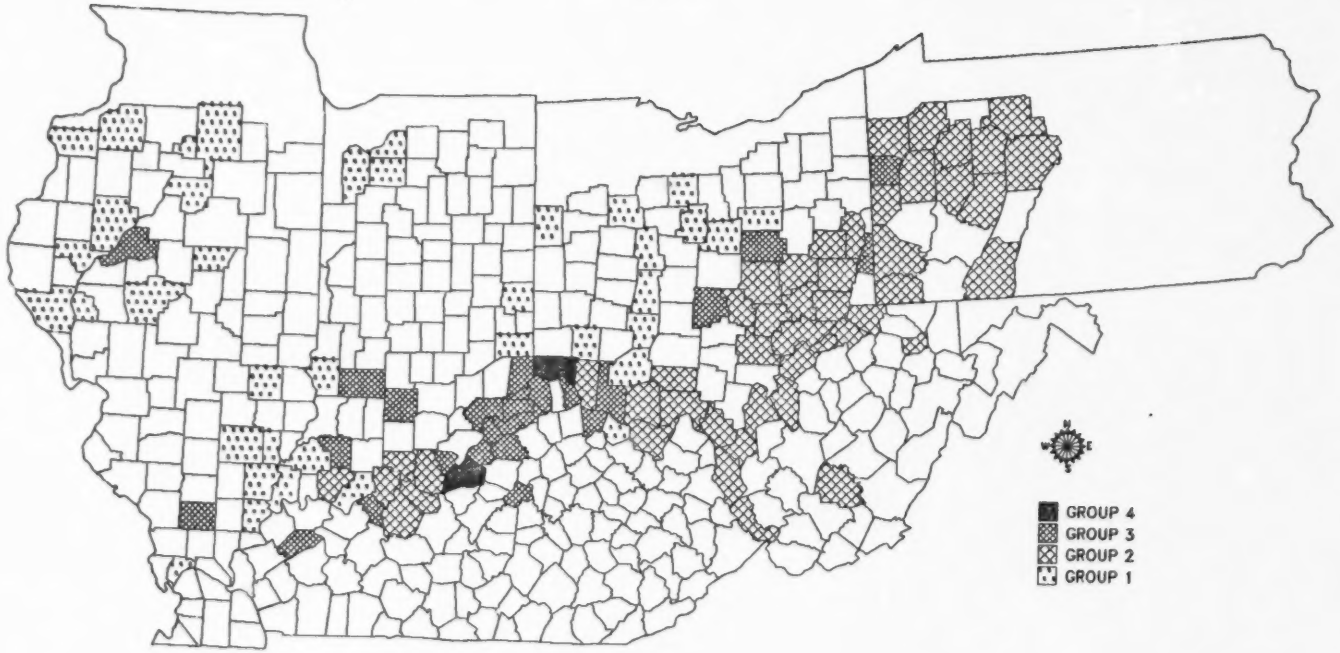
COUNTY IMPACT GROUPS USING
HOUSING VARIABLES



PREPARED FOR OHIO RIVER BASIN ENERGY STUDY
BY CAGIS/UICC, MARCH, 1980

Figure 7

COUNTY IMPACT GROUPS USING POPULATION VARIABLES



PREPARED FOR OHIO RIVER BASIN ENERGY STUDY

BY CAGIS/UICC, MARCH, 1980

Table 34

Group Statistics for Selected Variables Using Alternative Classification Schemes

	Classification Based on Housing				Classification Based on Income			
	Group 1 N=28	Group 2 N=46	Group 3 N=38	Group 4 N=2	Group 1 N=21	Group 2 N=44	Group 3 N=42	Group 4 N=7
Variable	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
% Old Housing	64.8	61.6	54.2	40.0	62.6	61.5	58.4	44.9
% New Housing	14.7	15.4	21.2	24.4	15.3	15.6	19.2	22.3
% Housing Vacant	6.2	8.7	7.0	4.8	6.1	8.2	7.9	3.9
% Net Migration '70-'76	1.6	3.4	2.5	-7.0	1.4	2.8	3.4	-1.9
Total Urban Population (1000's)	8.0	15.4	21.5	773.0	15.3	15.1	12.5	255.4
Median Family Income	8450.	7420.	8328.	10153.	8481.	7473.	8023.	10112.0
Total Employment (1000's)	11.4	14.7	14.7	311.2	13.0	14.8	10.3	117.4
% Manfac. Employees	30.5	30.4	30.9	32.3	25.7	31.2	31.9	34.5
% Agricultural Employees	11.3	8.6	5.9	0.5	13.5	5.7	9.2	2.3

Table 34 (Cont'd)

	Classification Based on Population				Classification Based on Employment			
	Group 1 N=38	Group 2 N=47	Group 3 N=27	Group 4 N=2	Group 1 N=29	Group 2 N=46	Group 3 N=37	Group 4 N=2
Variable	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
% Old Housing	62.5	58.9	58.0	40.0	62.7	60.1	57.6	40.0
% New Housing	16.4	16.6	19.3	24.5	16.2	16.4	18.9	24.5
% Housing Vacant	6.8	8.0	7.5	4.8	7.7	7.3	7.5	4.8
% Net Migration '70-'76	1.0	3.2	4.1	-7.0	3.2	2.0	3.1	-7.0
Total Urban Population (1000's)	9.5	21.6	13.9	773.0	5.4	24.3	13.0	773.0
Median Family Income	8359.	7667.	8015.	10152.	7498.	8039.	8301.	10152.
Total Employment (1000's)	11.4	17.7	10.7	311.2	7.0	19.2	12.7	311.2
% Manufacturing Employment	28.5	31.8	31.5	32.3	23.9	33.5	32.2	32.3
% Agricultural Employees	12.6	4.4	9.2	0.5	17.8	3.4	7.1	0.5

Table 35
Group Membership for Case Study Counties
Groups Based on Variables In[2]

County	Housing	Population	Employment	Income
Jasper, Ill.	1	1	1	1
Jefferson, Ind.	3	3	3	2
Spencer, Ind.	2	1	1	3
Trimble, Ky.	3	3	1	3
Adams, Ohio	2	2	1	2
Beaver, Pa.	2	2	2	1
Mason, W. Va.	2	2	2	2

Table 36
Description of the Classification of Candidate Counties and Potential for Socioeconomic Impacts

Variable Type	Group	Group Descriptions	Potential for Impact
Population	1	Smallest populations, density, most rural	High
	2	Largest populations, density, most urban, lowest dependency ratio	Low
	3	Medium size, density, dependency ratio	Medium
Housing	1	Fewest units, lowest vacancy, many with public sewer, water least crowded units	Medium to High
	2	Largest # units, largest vacancy, most crowding fewer with public sewer, water	Low
	3	Medium # units, vacancy, crowding, most with public sewer, water	Medium to High
Income	1	Fewest below poverty, largest median income, largest buying income, fewest old age on assistance, largest ADC*	Low
	2	Highest families below poverty, lowest median income, lowest buying income, medium # persons on public assistance	High
	3	Median income between year 2 & 3, families below poverty, ADC, buying income, highest old age public assistance	Medium
Employment	1	Most people in agriculture, lowest workforce, lowest in manufacturing, services, craftsman	Highest-Induced migration but lowest employment benefits
	2	Fewest in agriculture, most manufacturing, mining, total employees, medium in services	Lowest, induced migration Highest employment benefits
	3	Medium in agriculture, total employees, craftsmen, manufacturing, highest in services, lowest in mining	Medium

6.0 Summary and Conclusions

Our case study analysis set out to delineate those site specific socioeconomic impacts that can occur due to power plant location and to test several of the assumptions and models being used in the regional analysis. Data limitations have prevented us from doing a complete evaluation on all the case study areas. However, we have been able to accomplish our major goals. Our results from the case study analysis can be summarized as follows:

- A wide range of socioeconomic issues can arise from any of the three phases in power plant siting: land acquistion, construction or operation.
- From the few monitoring socioeconomic impact studies that have been undertaken several trends have become apparent that lead to the hypothesis that the potential for large socioeconomic impacts should increase in those areas with fewer local workers available, less available rental housing and fewer available public services.
- In attempting to generalize local impacts to the regional level some classification of impacts and/or counties is necessary.
- The case study counties are indicative of the wide range of demographic, housing, income and employment characteristics that exist in the ORBES region.
- From historical data, 1965-1975, in energy development and socioeconomic conditions in Adams County, Beaver County and Jasper County we found that
  - -- the most substantial evidence of population, employment and county fiscal impacts occurred in Adams County - a small, rural, low income county.
  - -- little or no evidence of energy-related socioeconomic impacts was found in Beaver County, an SMSA county that is highly urbanized.
  - -- concurrent development of manufacturing industries, institutions, highways, or any other sectors can obscure the effects from power plant construction making it impossible to separate out cause and effect.
- Partial correlation and regression analysis was used to confirm that our model-derived construction employment figures are reasonable estimates of the observed changes in employment.
- Spencer County had the highest peak construction employment, 2,988 workers; Adams County the lowest at 400 workers.
- In only Trimble County does the number of inmigrants (including families estimated as 1.8 times the inmigrant workers) go above 10% of the 1975 population.

- An annual building rate was estimated from 1970 Census of Housing data to compare with the additional demand created by inmigrants for any given year of the scenario. Using an additional demand comprising more than 50% of the historical building rate as a cutoff point, five out of the seven case study counties show potential housing shortage problems. Jefferson and Beaver Counties, both semi-urbanized, are not among these five.
- Housing shortages can create both positive and negative effects. Construction and service industries may be stimulated. However, housing costs will almost certainly go up. Temporary housing may arise and be considered a negative effect by some but not by others.
- Water supply shortages associated with demand created by inmigrating power plant workers will be localized if they occur at all and are difficult to predict.
- Tax impacts of a power plant include net, long term tax benefits to the taxing district and county in which the plant is located.
- Tax benefits result in the ability of the community to either increase service levels or decrease tax rates.
- In the short term there can be a deficit tax revenues versus public service costs.
- There is a possibility of a geographic disparity in tax revenues varsus service costs related to the degree to which inmigrants settle outside the taxing district receiving the revenues from the plant.
- A wide array of socioeconomic variables was used to classify ORBES candidate counties into 4 groups. From our analysis of the classifications and in attempting to make generalizations based on the classifications we found that it was more meaningful to use separate classifications based on separate groups of variables relating to a specific impact area. Our resulting classifications are thus more refined than those employed in previous regional studies.

In conclusion, we can state that there are positive and negative socioeconomic impacts associated with power plant development. We have identified many but not all of these in our site specific analysis. We have been able to confirm many of our modeling assumptions as giving correct results and thus can proceed to use these methods in our regional analysis with greater confidence.

References

(1) Argonne National Laboratory, A Preliminary Assessment of the Health and Environmental Effects of Coal Utilization in the Midwest, Argonne, Ill: Argonne National Laboratory, January 1977.

(2) Sanderson, Debra and Michael O'Hare, Predicting the Local Impacts of Energy Development: A Critical Guide to Forecasting Methods and Models, Cambridge, Mass: Laboratory of Architecture and Planning, M.I.T., May 1977.

(3) Mountain West Research, Inc., Construction Worker Profile: Community Reports (7 volumes), prepared for The Old West Regional Commission, Washington, D.C., December 1975.

(4) Mountain West Research, Inc., Construction Worker Profile: Summary Report, prepared for The Old West Regional Commission, Washington, D.C., December 1975.

(5) Mountain West Research, Inc., Construction Worker Profile: Final Report, prepared for The Old West Regional Commission, Washington, D.C., December 1975.

(6) Pennsylvania Power and Light, A Monitoring Study of Community Impacts for The Susquehanna Steam Electric Station, Allentown, June 1976.

(7) Tennessee Valley Authority, Semiannual Construction Employment at TVA Plants, Employment by Kraft, obtained through correspondence with G.R. DeVeny, TVA, 1978.

(8) Tennessee Valley Authority, Hartsville Nuclear Plants: Socioeconomic Monitoring and Mitigation Report, Survey Reports for September 1976, March 1977, and September 1977, Knoxville, Tennessee, 1977 and 1978.

(9) Tennessee Valley Authority, Bellefonte Nuclear Plant: Construction Employment Impacts, Survey Reports for April 1975, May 1976 and August 1977; Knoxville, Tennessee, 1975, 1976 and 1977.

(10) Tennessee Valley Authority, Watts Bar Nuclear Plant: Construction Employment Impact, Survey Reports for May 1971, March 1973, July 1974, and May 1976; Knoxville, Tennessee, 1971, 1973, 1974 and 1976.

(11) Tennessee Valley Authority, Sequoyah Nuclear Plant: Construction Employment Impact, Survey Reports for October 1970, July 1972, August 1974 and February 1977; Knoxville, Tennessee, 1970, 1972, 1974, and 1977.

(12) Tennessee Valley Authority, Browns Terry Nuclear Plant: Construction Employment Impact, Survey Reports for September 1969, April 1971 and July 1973; Knoxville, Tennessee, 1969, 1971 and 1973.

(13) Tennessee Valley Authority, Cumberland Steam Plant: Construction Employment Impact, Survey Reports for September 1969, May 1971, and April 1973; Knoxville, Tennessee, 1969, 1971, and 1973.

(14) Pennsylvania Power and Light Company, A Monitoring Study of Community Impact: An Update. Allentown, Pennsylvania: P.P. & L. 1978.

(15) von Rabenau, B., "The Employment and Population Impact of Energy Facility Construction on Urban Areas in the ORBES Region", Draft Report, prepared for The Ohio River Basin Energy Study, September 1979.

(16) Urban Systems Research and Engineering, Classification of American Cities for Case Study Analysis by Elizabeth Cole et al. Report for Office of Research and Development, USEPA, Washington, D.C.: Urban Systems Research and Engineering, July 1976.

(17) Argonne National Laboratory, An Integrated Assessment of Increased Coal Use in the Midwest: Impacts and Constraints. Argonne, Ill.: ANL/AA-11 (Draft Report), October 1977.

(18) The Ohio State University and Purdue University, Preliminary Technology Assessment Report, Vol. II-A, Part 2 of Ohio River Basin Study, Indiana University, May 15, 1977.

(19) Darling, David, Data on Indiana Power Plant Tax Payments, Mimeo, 1979.

(20) Ohio Department of Taxation, Report on Kyger Creek Tax Payments, Mimeo, 1968.

(21) U.S. Bureau of the Census, 1972 Census of Governments, Washington D.C.: U.S. Government Printing Office, 1974.

(22) Oak Ridge National Laboratory, National Coal Utilization Assessment, Oak Ridge, Tenn.: Oak Ridge National Laboratory, October 1978.

(23) Veldman, D.J. (ed.), Fortran Programming for the Behavioral Sciences, New York: Holt, Rinehart and Winston, 1967.

(24) Abler, R.; Adams, J.S.; and Gould, P., Spatial Organization, Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971.

(25) Rummel, R.J., Applied Factor Analysis, Evantson, Ill.: Northwestern University, 1970.

(26) Gordon, S.I. and Graham, A.S., Regional Socioeconomic Impacts of Alternative Energy Scenarios for the Ohio River Basin Energy Study Region, Columbus, Ohio: Department of City and Regional Planning, The Ohio State University, forthcoming.

Appendix A
List of Data Sources Used for Site Specific Analysis

County	Source of Information	Type of Information
All	U.S. Bureau of the Census, County Business Patterns 1965-1976	Employment by Industry
	U.S. Bureau of the Census, 1970 Census of Population	Population, Income, Occupations
	U.S. Bureau of the Census, 1970 of Housing	Housing
	U.S. Bureau of the Census, Current Population Reports, Series P-25, 1977	Population, Per Capita Income
	U.S. Bureau of the Census, 1977 Census of Governments	County Revenues and Expenditures
Jasper, Ill.	Illinois Tax Department	Property Valuations
	Jasper County Treasurer's Office	County Disbursements and Tax Revenue
	Alan Rudolph, Central Illinois Public Service Company	Newton Plant
	Illinois Institute for Natural Resources	Water Systems
Jefferson, Ind.	Gary Stegner, Region 12 Development Commission	Housing, Property Tax, Employment, Labor Force
	Indiana Department of Public Instruction	School Enrollment
	Jefferson County Auditor	Assessed Valuations, County Disbursements and Revenues
	Public Service of Indiana	Marble Hill
Spencer, Ind.	Spencer County Auditor	County Expenditures and Revenues, Property Valuations
	Indiana 15 Regional Planning Commission	Housing, Population
	Indiana Dept. of Public Instruction	School Enrollment
	Indiana and Michigan Electric Co.	Rockport Plant

Appendix A (continued)

County	Source of Information	Type of Information
Spencer, Ind.	Martin T. Pond Memo to Spencer County Study Committee Concerning Rockport Plant, April 2, 1979	Impact Study Report
	"An Assessment of the Greater Grandview Community and Its Opportunities for Improvement" by Community Development Staff and Students at Purdue University	Survey and Impact Analysis
Trimble, KY	Kentuckiana Regional Planning and Development Agency	Housing, Police, File, Water System
	Trimble County Clerk	Property Valuations
	Kentucky Auditor of Public Accounts	County Expenditures
	Louisville Gas and Electric	Trimble Co. Plant
Adams	Mrs. Helen Roush Adams Co. Reg. Planning Commission	Causes for Population Growth
	Jeffrey A. Spencer Ohio Valley Regional Development Commission	Water and Sewer Systems, Housing Conditions, Health Services, Fire and Police Services, Manufacturers
	Ohio Valley School District	School Enrollment
	Ohio Tax Equalization Dept.	Property Valuations
	Ohio Bureau of Employment Services	Labor Force, Unemployment
	Financial Reports for Counties Auditor's Office	Expenditures and Resources
	Bob Berker Killen Power Station	Killen Plant
	ODNR, Inventory of Municipal Water Supply Systems by County, Ohio Ohio Water Inventory Report # 24	Water System

Appendix A (continued)

County	Source of Information	Type of Information
Beaver, Pa.	Pennsylvania Bureau of Employment Security	Labor Force, Unemployment
	Pennsylvania Abstracts	Enrollments, Property Valuations, County Expenditures & Revenues
	Green International Inc., Comprehensive Water Quality Management Plan May 1976 for Pa. Dept. of Environmental Resources	Water Systems
	Ohio Edison	Beaver Valley Plant, Bruce Mansfield Plant
Mason	Region II Planning and Development Commission	Major Industries, Community Facilities, Sewer and Water, Police and Fire
	Mason County Board of Education	School Enrollments
	Appalachian Power Company	Mountaineer Plant
	State Tax Commissioner "Study of Property Valuations As They Relate to Levies Laid for the Support of Schools in West Virginia"	Property Valuations
	West Virginia Tax Department, Local Government Relations Division	County Expenditures and Revenues

APPENDIX B

ORBES Labor Impact Model

The ORBES Labor Impact Model estimates the following impacts by year for every county hosting the construction of an electric generating facility:

1. Construction manpower requirements
2. Operations manpower requirements
3. Inmigration from construction workforce
4. Inmigration from construction and operation workforce
5. Employment multiplier effect
6. Payroll generated by total construction and operation workforce
7. Payroll generated by inmigrant workforce (local payroll)
8. Income multiplier effects
9. State income tax generated from local payroll

Regional impacts are also estimated for each year of the scenario:

10. Total construction manpower requirements
11. Total operation manpower requirements
12. Total construction manpower requirements by skill

Each of these items will be discussed briefly below.

Construction and Operation Manpower Requirements (Items 1 and 2)

A ratio of construction manpower requirements per megawatt capacity was derived for the following types of energy facilities:

coal, single unit, no scrubbers
coal, part of a multiple unit, no scrubbers
coal, single unit, scrubbers
coal, part of a multiple unit, scrubbers
nuclear

A similar ratio was derived for operation manpower requirements for coal units with scrubbers, coal units without scrubbers and nuclear units. These ratios were derived as an average of actual or reported manpower requirements per megawatts as published in EIS's, ER's, or other reports/publications.

The construction schedules used in the model are:

coal units less than 1000 MW	5 years
coal units 1000 MW or greater	6 years
nuclear units	7 years

Inmigration (Items 3 and 4)

Rates of inmigration of construction workers are permitted to vary for three different situations: 1) SMSA counties 2) counties within 50 miles of an SMSA, and 3) counties outside the 50 mile range. In our basic runs we use 5,10 and 30 percent as the rates of inmigration for the respective situations listed above.

For operation workers it is assumed that fully 100% of the workforce migrates to the host county

Employment Multiplier (Item 5)

Employment multipliers by sub-region for manufacturing and construction were taken from an Argonne National Laboratory report written by Erik J. Stenehjem and James E. Metzger entitled A Framework for Projecting Employment and Population Changes Accompanying Energy Development Phase I (August, 1976). These multipliers are:

Indiana	1.5
Indiana	1.2
Kentucky/Tenn	1.5
Ohio	1.5
Northeastern States (Penn)	1.4
West Va/Va Maryland	1.1

Payroll (Items 6 and 7)

Payroll is input into the model as an average for all construction and operation workers. Our initial sums include $18,000 as this value.

Income Multiplier (Item 8)

The income multipliers used in the model are approximately 15% less than the employment multipliers. These are:

Illinois	1.28
Indiana	1.05
Kentucky	1.28
Ohio	1.28
Pennsylvania	1.19
West Virginia	1.00

State Income Tax (Item 9)

Average state income tax rates are part of the input to the model. Our i-itial sums use the following 1975 rates derived from a U.S. Bureau of the Census report entitled State Tax Collections in 1976.

Illinois	$150 per $10,000 income
Indiana	$134
Kentucky	$151
Ohio	77
Pennsylvania	142
West Virginia	135

Regional Construction and Operation Manpower (Items 10 and 11)

Regional Manpower Requirements are simply the sums of the county totals by year.

Skill (Item 12)

To break down the labor demand by skill it was necessary, first, to separate the construction workers at coal-fired plants from those at nuclear units. The percentage of workers by skill category for coal and nuclear units was derived as an average of the figures presented in the literature. These percentages were applied to the yearly labor demand for coal and nuclear units and then summed to give a total regional labor demand by skill.

A detailed explanation of Items 1,2, and 12 was contained in an ORBES memo from Steve Gordon dated June 9, 1979 and is also given in another report. (Gordon and Graham, 1979) Please refer to these writeups for an explicit statement of methods and references used to derive manpower and skill demands.